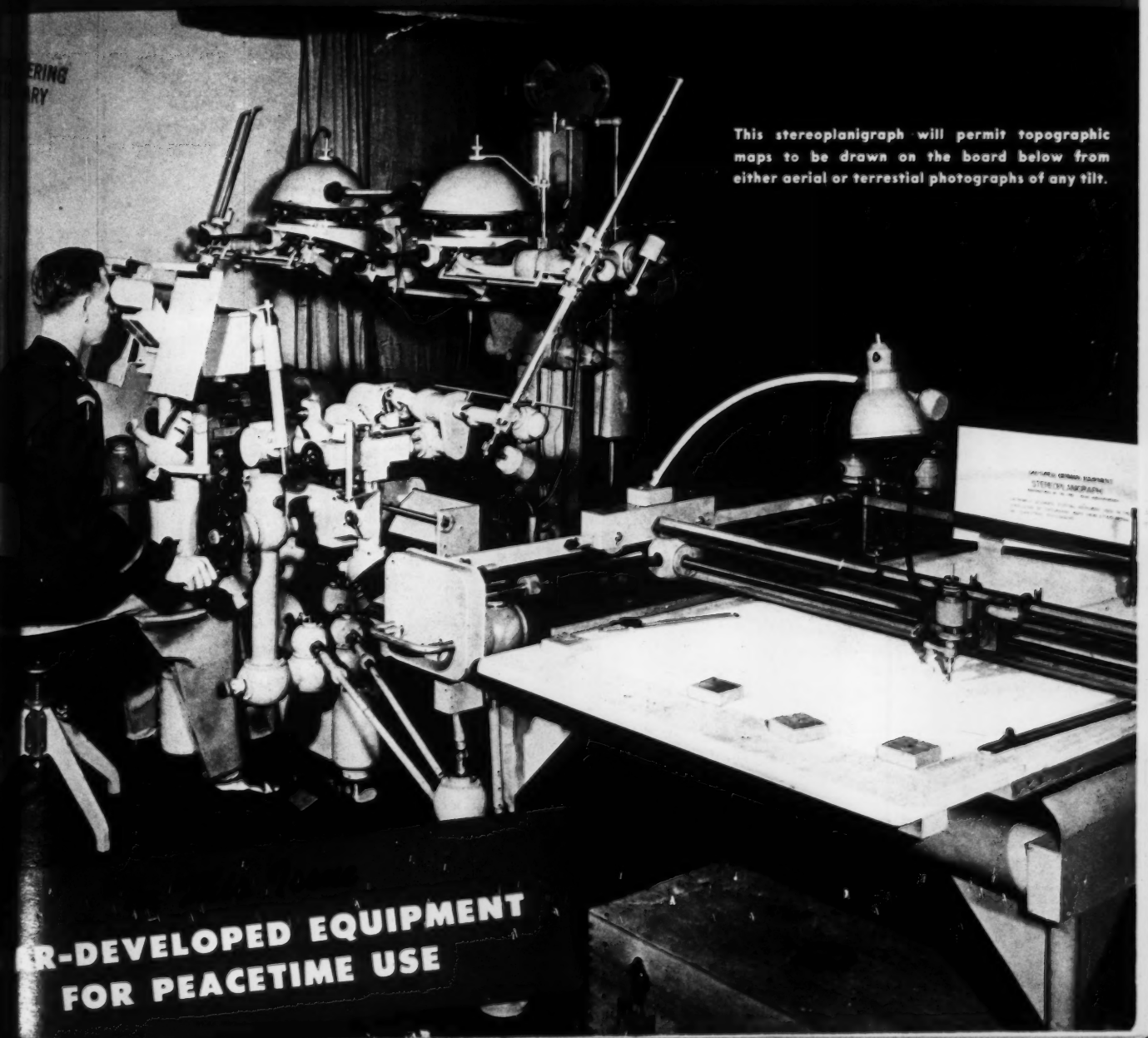
ENGINEERING NEWS-RECORD

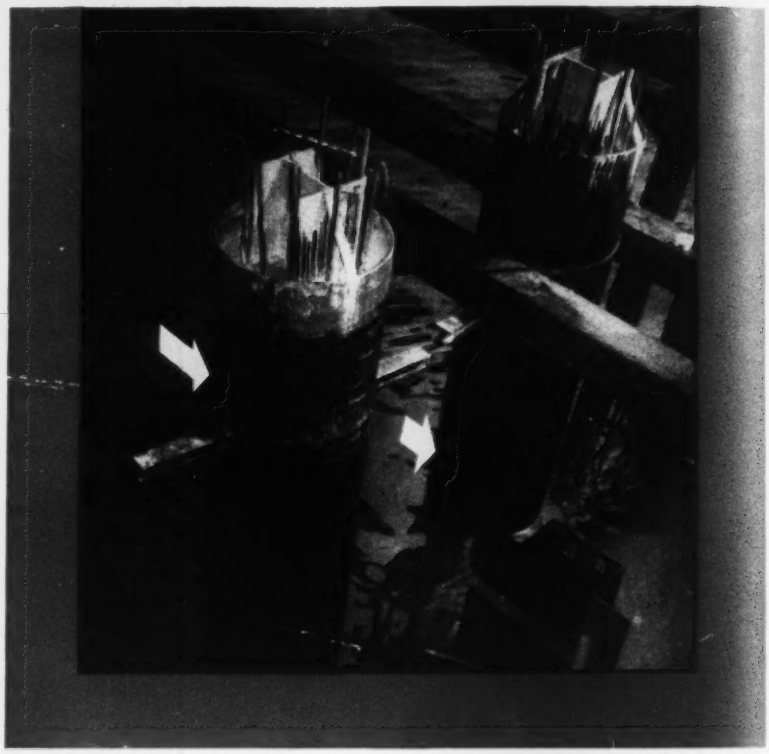
JUNE 13, 1946



This stereoplanigraph will permit topographic maps to be drawn on the board below from either aerial or terrestial photographs of any tilt.

R-DEVELOPED EQUIPMENT FOR PEACETIME USE

BYERS WROUGHT IRON fortifies this seawall against corrosive attacks



In the marginal wharf recently constructed at the Boston Naval Shipyard, wrought iron plays an interesting triple role. Cylinders fabricated of Byers Wrought Iron plates were installed around the steel columns supporting the structure, and filled with concrete. The cylinders serve as forms, as casings, and as "armor" against corrosive attack.

The selection of wrought iron for such applications is supported by a wealth of service records, including some that have become engineering legend. When the old Fort Mason dock in San Francisco was dismantled, the 50-year old wrought iron piles were found in such good condition that they were reused. An inspecting engineer reported that there appeared to be no marked difference between corrosion that had taken place below low water, between high and low water, and above, where the piles were reached by spray. The substructure was considered to be in first class condition, and by replacing the I-beam cap and braces (made of ordinary materials) would have been good for another long period of service.

Engineers have also made extensive use of wrought iron casings in repairing both metal and masonry piles and piers. In a number of instances the casings have been utilized as caissons while the necessary preparatory work on the pier was carried on, and later as forms for the concrete.

Wrought iron's unusual resistance to corrosion is due to its unusual composition and structure. Tiny fibers of glass-like silicate slag, threaded through the matrix of high-purity iron, halt and diffuse corrosive attack. They also help to anchor the initial protective film, which shields the underlying metal.

If you have any bridge, wharf or pier construction in mind, you will find some helpful information in our bulletin, "The Use of Wrought Iron in Salt Water Services." Ask for a copy.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, Seattle, San Francisco.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

ENGINEERING LIBRARY

ENGINEERING NEWS-RECORD

Devoted to Buildings, Sewerage, Waterworks, Bridges, Roads, Dams, Foundations, Earthwork, Flood Control, Public Works, Airports, Irrigation, Canals, Tunnels, Railroads

Volume 136 • Number 24 June 13, 1946

ALBERT E. PAXTON.....*Publisher*
WALDO G. BOWMAN.....*Editor*
EDWARD J. CLEARY.....*Executive Editor*

ASSOCIATE EDITORS V.T. BOUGHTON, H.W. HUNT *(New York)*, V. B. Smith and J.R.Carr *(Chicago)*, N.A.Bowers, *(San Francisco)*, A. N. Carter *(Washington)*

ASSOCIATE EDITORS—E. R. Denmark, F. S. Merritt, H. P. Orland *(New York)*, L.L. Wise *(San Francisco)*

NEWS EDITORS—E. E. Halmos, Jr., T. D. MacGregor

BUSINESS NEWS STAFF—Elsie Eaves, J. A. Mahoney, J. V. McEwen, M. R. Roessler

ECONOMIC STAFF—D. M. Keezer, Wm. Butler

ENGINEERING NEWS-RECORD
Published By
McGRAW-HILL PUBLISHING CO., INC.

Publication Office:
99-129 Broadway, Albany 1, N. Y.

Editorial and Executive Office:
330 W. 42nd St., New York 18, N. Y.

Engineering News-Record. Copyright 1946 by McGraw-Hill Publishing Co., Inc. All rights reserved. Printed in the U. S. A. Cable Address: "McGrawhill, New York". Member of A. B. P. and A. B. C. Entered as second-class matter Oct. 29, 1936, at the Post Office at Albany, N. Y., under the Act of March 3, 1879. Return postage guaranteed.

James H. McGraw, Founder and Honorary Chairman; James H. McGraw, Jr., President; Curtis W. McGraw, Senior Vice-President and Treasurer; Joseph A. Gerardi, Secretary; Nelson Bond, Director of Advertising; Eugene Duffield, Editorial Assistant to the President; J. E. Blackburn, Jr., Director of Circulation.

All communications about subscriptions should be addressed to the Director of Circulation, 99-129 N. Broadway, Albany (1), N. Y., or 330 W. 42nd St., New York (18), N. Y. Allow ten days for change of address. Subscription rates—Single copy 25 cents; United States and possessions, Latin American Republics, $5.00 for one year, $8.00 for two years, $10.00 for three years. Please indicate position and company connection on all subscription orders.

District Offices and Managers: Fred G. Hudson and L. H. Hunt, 520 N. Michigan Ave., Chicago; J. W. Otterson, 68 Post St., San Francisco; J. M. Spackman, McGraw-Hill Bldg., New York, N. Y.; A. B. Cozzens, 16 S. Broad St., Philadelphia; E. E. Duff, Jr., Hanna Bldg., Cleveland; B. F. Horn, Penobscot Bldg., Detroit; W. G. Payne, Continental Bldg., St. Louis; R. N. Phelan, 621 S. Hope St., Los Angeles; J. L. Ballard, Statler Bldg., Boston; Ralph Maultsby, Rhodes-Haverty Bldg., Atlanta, Ga.; Pittsburgh, Oliver Bldg.; Washington, D. C., National Press Bldg.; England, Aldwych House, Aldwych, London, W. C. (2).

FEATURES IN THIS ISSUE

News of the Week..... 85

Editorials..... 94

One-Man Stone Rip-Rap Made in Primary Crusher..... 96

Dug Wells Solve Amazon Water Supply..J. A. LOGAN & J. L. HUMMEL 98

Welding Repairs on 4000-ft. Viaduct.....J. M. HEFFELFINGER 102

Piles and Pile Foundations—Part III.....R. D. CHELLIS 104

Garrison Dam to Make Rolled Fill History..... 110

Concrete Pavements Survive 35 Years of Service.....K. C. GAYNOR 113

Three-Story Building on Roller Bearings..... 115

Peacetime Jobs for War-Developed Tools..... 118

Pollution Bill Faces Congressional Test..... 122

Falling Boulder Damages Penstocks and Power House..... 124

DEPARTMENTS

Construction Trends..... 79
From Field & Office..... 125
Comment and Discussion..... 126
Book Notes and Reviews..... 127
Material Prices..... 130
Elections and Activities..... 137
New Aids..... 140
Men and Jobs..... 150
Manufacturers Activities..... 166
Manufacturers Publications..... 176
Construction Reports..... 213

Number of copies of this issue printed—43,928

CHANGE OF ADDRESS

ENGINEERING NEWS-RECORD, 330 West 42nd Street, New York 18, N. Y.

Director of Circulation

Please change the address of my subscription.

Name .....

Old Address .....

New Address .....

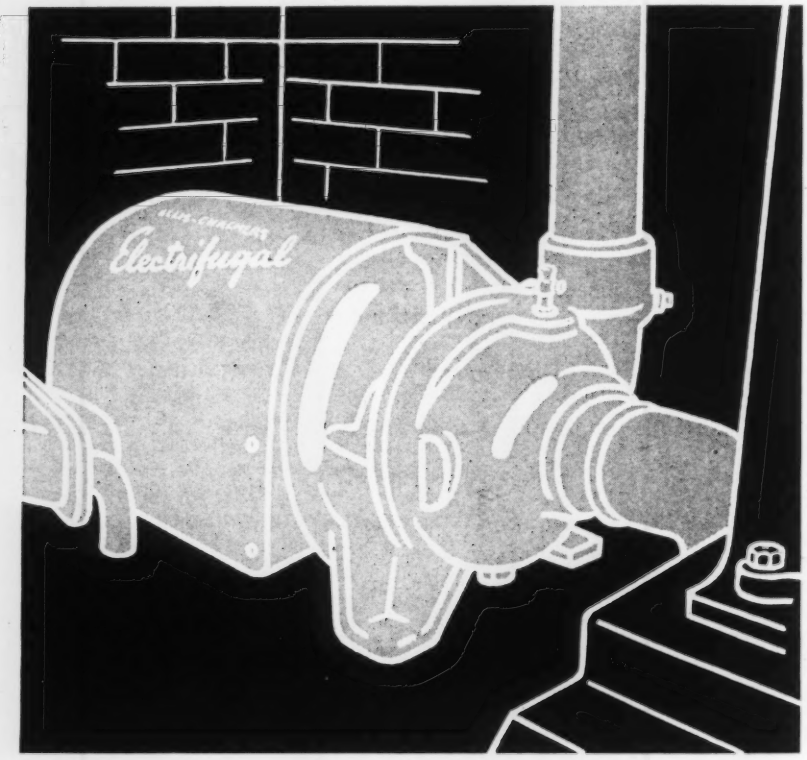
New Company Connection.....

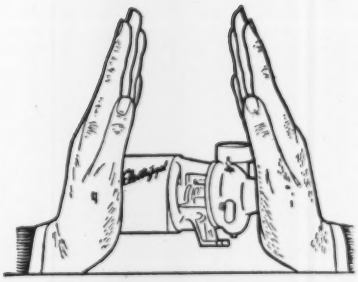
New Title or Position.....

Economical "Package" Pump Saves SPACE and MONEY

By combining pump and motor into one compact unit, Allis-Chalmers engineers created the "Electrifugal" pump — that requires *one-third less space.* But . . . more than that . . . it costs you *less to buy — less to install — less to operate* — and has a wide range of applications.

The "Electrifugal" pump is a popular member of the complete Allis-Chalmers line of centrifugal pumps and motors: single or double suction — multi-stage — capacities to 170,000 gpm.





MORE QUICKLY INSTALLED

Comes completely assembled. Just bolt down four supports, make pipe and power connections — and start pumping! Operates in any position.

MORE QUICKLY SERVICED

Easy to get at rotor, impeller, packing and all moving parts. Take it apart and put it together fast. Down time reduced to a minimum.

YOU SAVE ON MAINTENANCE

Ample bronze wearing rings — seal cage and valve—shaft sleeve and deflector — five packing rings — precision workmanship and other quality features add up to longer life, less maintenance cost.

UNDIVIDED RESPONSIBILITY

Allis-Chalmers builds both pumps and motors — backs them up with unsurpassed experience and reputation in both fields. Call your A-C office or dealer for help on any pumping problem . . . or write for bulletin No. B6018. ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN.

TIGHT SQUEEZE! — But this "Electrifugal" pump was built for close quarters. Allis-Chalmers engineers have developed and perfected the close-coupled pump through 20 years of experience. Built in stock sizes from ¾ to 25 h.p.

A 2037

ALLIS-CHALMERS

One of the Big 3 in Electric Power Equipment-
Biggest of All in Range of Industrial Products

Electrifugal PUMPS

New Construction Volume in May

Total volume for 5-week month is $560,244,000, 240 percent over last year. Private construction rate 25 percent below April and State and Municipal construction 1 percent above last month but 878 and 357 percent over last year

Civil engineering construction volume in continental United States totals $560,244,000 for May, an average of $112,049,000 for each of the five weeks of the month. This average is 16 percent below the average for the four weeks of April, and is 240 percent above the May, 1945 average.

Private construction for May on a weekly average basis is 25 percent below last month, but 878 percent greater than May, 1945. Public construction is 1 percent below last month and 78 percent above last May. State and Municipal construction, while 1 percent above last month, is 357 percent above the average for May, 1945. Federal construction, down 5 percent from last month, is down 22 percent below May, 1945.

Weekly averages in the various classes of construction for May, 1946, compared with April show gains only in earthwork and waterways, 53 percent; in highways of 15 percent, and in public bridges, 8 percent; losses in public buildings, 47 percent; industrial buildings, 22 percent, commercial buildings, mostly mass housing, 20 percent; private bridges, 15 percent, sewerage, 15 percent; public unclassified, 36 percent, and private unclassified, 71 percent. Waterworks held its own.

Geographically only two sections show gains in May, 1946 over April—South, 12 percent and Far West, 26 percent. New England dropped 21 percent below, Middle Atlantic, 46 percent, Middle West, 52 percent, and West of Mississippi, 18 percent.

All sections made strong gains in May over May 1945, New England, 211 percent; Middle Atlantic, 365 percent; South, 164 percent, Middle West, 124 percent; West of Mississippi, 168 percent; and Far West, 390 percent.

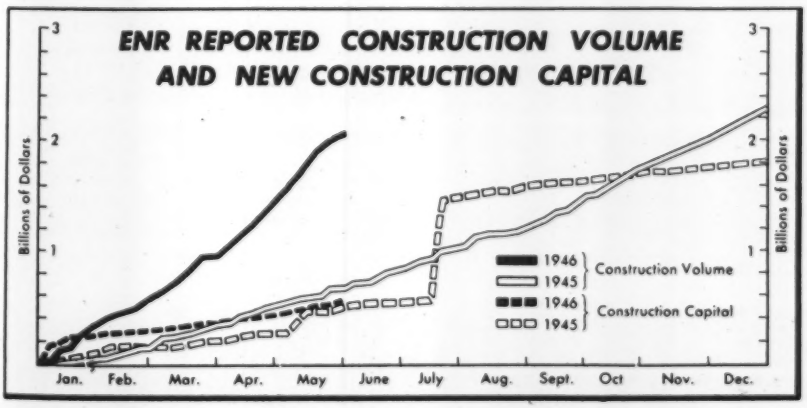
New capital for construction purposes for the five weeks of May, 1946 totals $154,520,000, or a weekly average of $30,904,000, 49 percent above April, 161 percent over May, 1945.

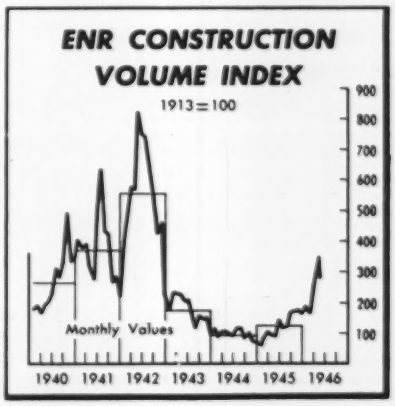
ENGINEERING CONSTRUCTION CONTRACTS REPORTED TO ENGINEERING NEWS-RECORD—MAY, 1946

Engineering News-Record *reports continental U. S. Construction projects of the following minimum costs — waterworks, excavation, drainage and irrigation,* $22,500; *other public works,* $40,000; *industrial buildings,* $55,000; *other buildings,* $205,000

Five Weeks — Thousands of Dollars (000 Omitted)

	New England	Middle Atlantic	South	Mid West	West of Mississippi	Far West	United States May 1946	United States Five Months 1946	United States Five Months 1945	Canada
Public Works										
Waterworks	342	918	2,183	1,351	2,595	551	**7,940**	**41,306**	17,001	430
Sewerage	279	1,587	1,218	1,409	2,153	909	**7,555**	**26,818**	11,985	1,314
Bridges, public	593	2,382	4,241	2,349	3,261	2,032	**14,858**	**49,112**	7,466	145
Earthwork and waterways	738	1,603	19,820	179	24,530	6,296	**53,166**	**150,694**	14,427	38
Streets and roads	6,543	11,815	28,972	15,321	29,145	11,714	**103,510**	**287,048**	67,251	5,042
Buildings, public	1,194	6,256	2,829	3,132	9,328	2,376	**25,115**	**123,703**	276,657	9,745
Unclassified, public	547	5,387	798	819	983	11,966	**20,500**	**68,486**	99,613	272
Total public	**10,236**	**29,948**	**60,061**	**24,560**	**71,995**	**35,844**	**232,644**	**747,167**	**494,400**	**16,986**
Federal government (included in above classifications)	1,387	3,118	23,004	1,152	28,378	18,451	**75,490**	**248,770**	398,989	.....
Private										
Bridges, private	.....	.....	.....	.....	115	.....	**115**	**1,321**	3,631	.....
Industrial buildings	8,244	15,278	19,286	12,222	9,016	16,611	**80,657**	**417,434**	132,325	**16,388**
Commercial buildings	9,322	43,355	13,182	13,031	17,268	139,604	**235,762**	**831,202**	34,922	**7,32**
Unclassified, private	255	166	1,133	712	7,430	1,370	**11,066**	**79,593**	20,263	2,600
Total private	**17,821**	**58,799**	**33,601**	**25,965**	**33,829**	**157,585**	**327,600**	**1,329,550**	**191,141**	**26,308**
Total Engineering Construction:										
May, 1946 — 5 weeks	**28,057**	**88,747**	**93,662**	**50,525**	**105,824**	**193,429**	**560,244**	.....	.....	**43,294**
April, 1946 — 4 weeks	28,471	132,145	66,904	83,490	102,657	122,523	**536,190**	.....	.....	27,230
May, 1945 — 5 weeks	8,976	19,108	35,296	22,712	39,319	39,544	**164,955**	.....	.....	10,098
Five Months — 1946	**133,299**	**428,307**	**268,706**	**253,739**	**417,207**	**575,459**	.....	**2,076,717**	.....	**141,838**
Five Months — 1945	26,906	91,767	134,743	95,044	171,357	165,724	.....	.....	685,541	45,083





Ryerson—Quick Source for

INLAND 4-WAY FLOOR PLATE

Take a careful look at this close-up of Inland 4-Way Floor Plate. Note the 4-way projections.

Now read of the advantages Inland 4-Way Floor Plate provides:

1. *Safer traction* on walkways, stairways, around machinery and wherever sure footing is important. The 4-way projections grip feet or wheels from every angle. Give 4-way protection against dangerous falls.

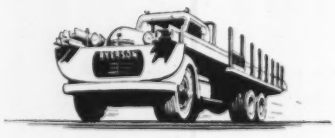
2. *Longer wear.* Inland floor plate is rolled from tough, open hearth steel with high wear resisting qualities.

3. *Great structural strength.* The overlapping projections reinforce lengthwise and crosswise giving Inland 4-Way Floor Plate greater stiffness. It has a tensile strength of 55,000 lbs. and an elastic limit of 35,000 lbs. per square inch.

Then you get the additional advantage of a continuous pattern that is pleasing in appearance; matches whether laid side to side or end to end and permits sweeping and drainage in four directions.

Inland 4-Way Floor Plate is available for quick delivery from Ryerson Steel-Service Plants, in two pattern sizes and several thicknesses. Write for catalog and samples too if you care for them.

JOSEPH T. RYERSON & SON, INC. Steel-Service Plants at: Chicago, Milwaukee, Cleveland, Cincinnati, St. Louis, Detroit, Philadelphia, Pittsburgh, Buffalo, Boston, New York.

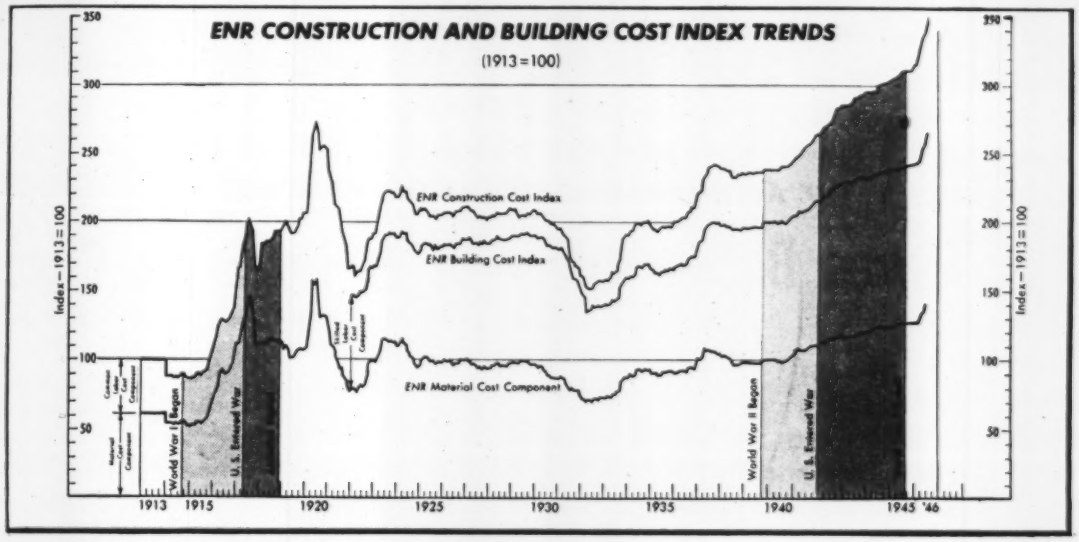


NEED TUBING?

Ryerson stocks of seamless mechanical tubing, boiler tubes and Allegheny Stainless tubing are large and complete. Contact nearest Ryerson plant for prompt delivery.

RYERSON STEEL

JUNE CONSTRUCTION BUSINESS REPORT



ENR CONSTRUCTION VOLUME AND NEW PRODUCTIVE CAPITAL

Thousands of Dollars (,000 omitted)	May 1945 (5 wk.)	May 1946 (5 wk.)	% Change	Five Months 1945 (22 wk.)	Five Months 1946 (22 wk.)	% Change
Total U. S. Construction	$164,955	$560,244	+240	$685,541	$2,076,717	+203
Private Construction	33,498	327,600	+878	191,141	1,329,550	+596
Public Construction	131,457	232,644	+77	494,400	747,167	+51
Federal	97,058	75,490	−22	398,989	248,770	−38
E N R Construction Volume Index, 1913 = 100	93	284	+205	87	248	+185
Total New Productive Capital	233,017	154,520	−34	511,710	594,479	+16
Private Investment	59,144	154,520	+161	239,800	436,159	+82
Federal (non-federal work)	.....	.....	.....	20,900	.....	.....
Federal (federal work)	173,873	.....	.....	251,010	158,320	−37

CONSTRUCTION COST . . . . WAGE RATES . . . . MATERIAL PRICES

1913 = 100	June 1945	June 1946	% Change	Change May to June 1945 May	1945 June	%	1946 May	1946 June	%
E N R Constr. Cost Index†	308.99	347.91	+12.60	307.43	308.99	+.51	339.69	347.91	+2.42
E N R Build. Cost Index†	239.37	264.16	+10.36	238.46	239.37	+.38	257.25	264.16	+2.69

† *Does not reflect increased costs due to overtime, lower labor efficiency, delivery delays, etc.*

ENR 20-CITIES' AVERAGE

	June 1945	June 1946	% Change	1945 May	1945 June	%	1946 May	1946 June	%
Common Labor	$0.916	$1.034	+12.88	$0.909	$0.916	+.8	$1.018	$1.034	+1.57
Skilled labor (Av. 3 trades)	1.661	1.798	+8.25	1.650	1.661	+.7	1.7718	1.798	+1.48
Bricklayers	1.762	1.918	+8.85	1.747	1.762	+.9	1.8817	1.918	+1.93
Structural Ironworkers	1.712	1.80	+5.14	1.705	1.712	+.4	1.7908	1.80	+.51
Carpenters	1.510	1.677	+11.06	1.498	1.510	+.8	1.643	1.677	+2.07
Cement, per barrel	2.74	2.774	+1.24	2.74	2.74	0	2.78	2.774	−.21
Reinforcing Steel, cwt	2.79	3.19	+14.35	2.79	2.79	0	3.058	3.19	+4.32
Structural Steel, base	2.10	3.778	+79.90	2.10	2.10	0	2.35	3.778	+60.77
Sand, per ton	1.24	1.395	+12.50	1.24	1.24	0	1.377	1.395	+1.31
Lumber, 2x4 Fir, per M ft.	55.87	66.515	+19.05	55.57	55.87	+.5	60.39	66.515	+10.14
Lumber, 2x4 Pine, per M ft.	53.44	60.412	+13.05	53.44	53.44	0	57.70	60.412	+4.70
Common brick, per M	18.46	21.125	+14.44	18.48	18.46	−.1	20.23	21.125	+4.42
Ready-mixed concrete, c.y.	7.60	7.973	+4.91	7.57	7.60	+.4	7.88	7.973	+1.18
Struct. clay tile, 3x12x12	84.75	92.316	+8.93	84.75	84.75	0	91.52	92.316	+.87

MATERIAL SHIPMENTS . . . . BUILDING PERMITS

	May 1945	May 1946	% Change	April 1946	% Change April to May
Steel (% Operating Capacity) A. I. S. I.	94.0	50.1	−47	84.4	−41

	February 1945	February 1946	% Change	Two Months 1945	Two Months 1946	% Change
Cement, thous. bbl. U.S.B. of Mines	4,572	7,853	+72	9,445	15,244	+61

	April 1945	April 1946	% Change	Four Months 1945	Four Months 1946	% Change
Fabricated Structural Steel, tons, A.I.S.C.	50,701	110,420	+118	210,200	384,516	+83
Building Permits, 215 Cities, Dun & Bradstreet (,000 Omitted)	61,077	240,549	+294	246,045	1,070,239	+335

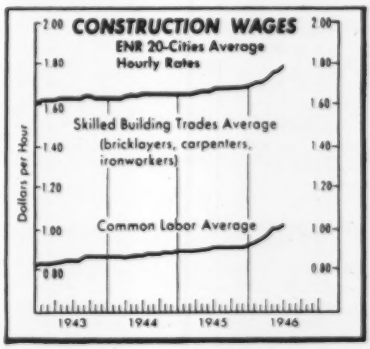
COST OF LIVING INDEX . . . . EMPLOYMENT

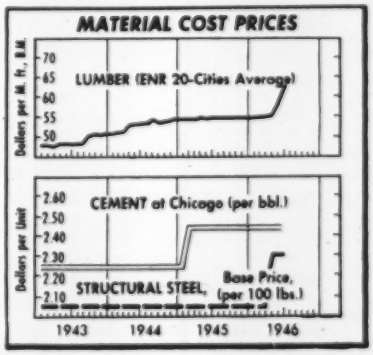
	March 1945	March 1946	% Change	February 1946	% Change Feb. to Mar.
Cost of Living Index, B. L. S.	126.8	130.2	+2.7	129.6	+0.5
Rent (Housing) Index, B. L. S.	108.3	108.4	+0.1	108.3	−0.1

	March 1945	March 1946	% Change	February 1946	% Change Feb. to Mar.
Total Non-Agri. Empl. (est.), thous., B. L. S.	38,062	36,271	−4.7	35,360	+2.6
Constr. Employment (est.), thous., B. L. S.	636	1,349	+112.1	1,260	+7.1

ENR INDEX NUMBERS

Base = 100	Construction Cost 1913	Construction Cost 1926	Building Cost 1913	Building Cost 1926	Volume '13	Volume '26
June, 1946	347.91	167.24	264.16	142.80	..	..
May, 1946	339.69	163.29	257.25	139.06	284	125
April, 1946	334.59	160.83	254.37	137.50	340	149
Mar., 1946	323.83	155.66	245.41	132.66	256	112
Feb., 1946	319.52	153.59	243.94	131.86	167	73
Jan., 1946	316.32	152.05	242.23	130.94	189	83
Dec. 1945	313.48	150.69	240.82	130.18	163	71
Nov., 1945	309.28	148.67	240.55	130.00	173	76
Oct., 1945	309.28	148.67	240.35	129.93	167	73
Sept., 1945	309.28	148.67	240.07	129.77	164	72
Aug., 1945	309.08	148.57	239.94	129.70	119	52
July, 1945	308.99	148.53	239.64	129.54	119	52
June, 1945	308.99	148.53	239.37	129.40	133	58
May, 1945	307.43	147.78	238.46	128.90	93	41
1945 (Av.)	307.74	147.93	239.14	129.27	123	54
1944 (Av.)	298.63	143.39	234.73	126.89	96	42
1943 (Av.)	289.95	139.38	228.75	123.66	176	77
1942 (Av.)	276.31	132.82	222.39	120.22	553	243





Quick Facts About

ATLAS DURAPLASTIC

TRADE MARK REG. U. A. C. CO.

THE AIR-ENTRAINING PORTLAND CEMENT

That Makes Better Concrete at No Extra Cost

1. Complies with ASTM specifications: Provides the proper amount of entrained air by intergrinding with the cement the precise amount of air-entraining material needed for satisfactory field performance.

2. No extra cost: Sells at the same price as regular cement. Produces concrete that spreads, screeds and finishes more easily. Calls for no additional materials—merely the same care and good workmanship regularly employed.

3. Better concrete: Makes concrete more workable, more plastic, more cohesive and more uniform throughout.

4. More durable concrete: Requires less mixing water for a given slump; minimizes segregation and bleeding; tends to reduce manipulation scale; fortifies the concrete against freezing and thawing weather; renders paving concrete highly resistant to scaling action of de-icing salts.

5. Makes better concrete block: Reduces breakage, improves appearance, lowers water absorption and generally increases strength.

6. Called Duraplastic because it makes concrete more durable and more plastic.

Atlas Duraplastic air-entraining portland cement was originated and developed by Universal Atlas Cement Company. It is backed by eleven years of field and laboratory tests and research and proved by seven years of successful field performance. Duraplastic is specified by an increasing number of architects, engineers, contractors, dealers, ready-mix operators and concrete products makers. It is used for general concrete work—for paving, sidewalks, foundations, walls, gunite, slip-form work and concrete pipe and block.

Send for further information. Write to Universal Atlas Cement Company (United States Steel Corporation Subsidiary), Chrysler Building, New York 17, N. Y.

ENR-D-38

OFFICES: New York, Chicago, Philadelphia, Boston, Albany, Pittsburgh, Cleveland, Dayton, Minneapolis, Duluth, St. Louis, Kansas City, Des Moines, Birmingham, Waco.

"HOUR OF MYSTERY"—*Sponsored by U. S. Steel—Sunday Evenings—ABC Network*

A UNIVERSAL ATLAS PRODUCT

News of the Week

ENGINEERING NEWS-RECORD • JUNE 13, 1946 • VOLUME 136 • NUMBER 24

Senate committee approves St. Lawrence waterway pact

Favorable report made on joint Senate-House resolution approving the 1941 agreement with Canada providing for the construction of major power and navigation facilities

Construction of the St. Lawrence power and navigation project was brought nearer to reality last week when the Committee on Foreign Relations of the Senate recommended to that body that a joint resolution approving the 1941 agreement with Canada relating to the St. Lawrence project be approved without amendment after certain specified deletions have been made. If the modified agreement is approved by both the Senate and the House it still has to be approved by the Canadian government before it becomes effective.

The committee recommends deletion of Article VII of the 1941 agreement which relates to navigation rights, and Article IX, which relates to diversion and use of water at Niagara. Both these sections cover matters that have been the subject of treaties in the past, and the committee holds that they could better be made the subject of treaties again. In this way it is hoped to avoid the treaty issue on which the 1941 agreement bogged down.

Also, Section IX provides for construction of works above Niagara Falls to produce a better distribution of the flow, which works were built during the war to permit greater diversions from the river for power development. Under the committee's plan, apportionment of the larger flow that now can be diverted for power at Niagara would be accomplished by a revision of the 1909 water treaty.

Provisions of the agreement

Under the 1941 agreement in the form now before the Senate, a Great Lakes-St. Lawrence Basin Commission is to be created with equal representation from Canada and the United States. This commission is to prepare plans and specifications for the proposed power and navigation facilities in the International Rapids section of the St. Lawrence, approve contracts for the work by either government and supervise construction.

Much work on preparing plans and specifications for the power and navigation facilities already has been done by the Corps of Engineers under orders issued by the late President Roosevelt when he hoped to undertake the work to aid this country's war effort. As a result, bids could be called within three months after funds are made available to the Army Engineers by Congress.

Work in International Rapids

Under the 1941 agreement, the United States would undertake the construction of all work in the International Rapids section. These include a dam to control the level of Lake Ontario and of the river above the rapids, a main dam and power houses on each side of the border in the Long Sault, and the necessary locks and canals for navigation. Also included is construction of dykes to reduce flooding land and dredging to enlarge the upper channel to reduce the velocity sufficiently to insure an ice cover, thus minimizing ice trouble in the power plants. Some of this work may be allocated to Canada by the commission.

The Canadian government agrees to build the locks and canals required for the seaway in the wholly Canadian section of the river.

Waterway depths

A depth of 27 ft. in the waterway and 30 ft. over the lock sills was called for in the 1941 agreement. The adequacy of the 27-ft. channel depth was questioned at the committee hearings in view of the drafts of the many Victory and Liberty ships built since the agreement

(*Continued on page* 88)

***Ford Plans Engineering Center**—The Ford Motor Co. has announced plans for a $50,000,000 Engineering center, to be built at Dearborn, Mich. To be built over an eight-year period, the center's 500 acres will include eight buildings grouped around an artificial lake, as shown in model. Buildings will be concrete and steel. Architects are Voorhees, Walker, Foley and Smith.*

NEWS IN BRIEF

In telegraphic form, here are latest news developments on the engineering and construction front during the week.

Construction—CPA has approved plans of the Standard Oil Co. of California to modernize its *Richmond, Calif.*, refinery wharfing facilities at a cost of $4,370,000. . . . During the first three-quarters of the current fiscal year *Florida* has authorized the expenditure of $3,594,112 for improvement of the physical plants of three state-supported colleges. . . . The John I. Case Co. will erect a $1,500,000 addition to its plant at *Rock Island, Ill.*. . . . Work has started on a $350,000 women's dormitory at Antioch College, *Yellow Springs, Ohio.* . . . Some officials believe Canada is planning to build a $10,000,000 power and irrigation dam on the South Saskatchewan River at *Elbow, Sask.* . . . B. A. Martin Co. and Hallman Bros. say they will build 425 houses for veterans at *Atlanta, Ga.*, to cost about $2,800,000. . . . Anheuser-Busch, Inc., plans a $20,000,000 brewery at *Newark, N. J.* . . . Aluminum Co. of America has plans for a $30,000,000 plant near *Davenport, Iowa*, to employ about 2,000. . . . John Deere Tractor Co., *Waterloo, Iowa*, has started the first unit of a plant expansion program which ultimately will cost $3,500,000. . . . At *Minneapolis, Minn.*, the "Star-Journal" and "Tribune" newspapers will build a 2-story, $485,000 reinforced concrete addition to their plant. . . . The *Pennsylvania* Postwar Planning Commission said that the state's municipalities and school districts have charted improvements to cost $94,000,000. . . . Construction permits in *Philadelphia, Pa.*, in May exceeded those of any other May in the last ten years. They totalled $4,997,190. . . . The Philadelphia Textile Institute Foundation will build a textile school at *Germantown* to cost over $1,000,000. . . . Food Fair Stores, Philadelphia, announces a $3,000,000 building program, including warehouses in Baltimore, Md., and Miami, Fla., and 15 supermarkets in various cities.

Highways—The *North Carolina* State Highway and Public Works Commission expects to receive an allocation of $10,000,000 from the highway fund surplus to be used on rural roads. . . . Erie Boulevard, built in the bed of the old Erie Canal through the center of *Syracuse, N. Y.*, is to be widened at an estimated cost of $1,000,000. . . . Three contracts totalling $796,000 have been awarded by the *Mississippi* State Highway Commission for 22½ miles of road work. . . . The *Texas* highway department is awarding construction contracts at the rate of approximately $5,000,000 a month. . . . The *Arizona* highway commission projected a $19,583,000 construction budget for the 1946-47 fiscal year. . . . Activity to remodel *Arkansas'* highway system, including proposals for a number of "super" highways was under way last week with petitions being circulated for an act to amend the Highway Bond Refunding Act to provide $150,000,000 for the project.

Waterworks and Sewerage—*Milwaukee, Wis.*, has placed orders for about $250,000 worth of water mains, valves and fittings. . . . The preliminary estimate of the cost of a new sewage disposal plant at *St. Petersburg, Fla.*, is $4,500,000. . . . Upon the eve of completion of a new river filtration plant at *Carthage, Tenn.*, residents were asked to be sparing in their use of water as a shortage is imminent.

Bond Issues—Voters at *Wilmington, N. C.*, May 29 approved a bond issue of $1,000,000 for water and sewer facilities extension and street paving. . . . *Napa, Calif.*, voters have approved a $1,750,000 issue for the pipe line of the Conn Valley water project. . . . Various counties in Oregon during May approved improvement bonds totalling about $1,000,000. . . . A bond issue will soon be offered for sale by *Maricopa County, Ariz.*, to finance $500,000 worth of county buildings. . . . It is expected that *St. Louis, Mo.*, voters on Aug. 6 will pass on a $4,000,000 municipal bond issue for facilities for the collection and disposal of ashes and other rubbish, these facilities to include two large incinerators.

P. W. Swain to report on Bikini atom bomb test

Engineering News-Record and the other McGraw-Hill business and technical publications will be officially represented at the atom bomb test this summer by Philip W. Swain, editor of *Power*. He sailed from Oakland June 12 on the press ship Appalachian, reaching Kwajalein Island June 28 and Bikini Atoll (Marshall Islands) June 29.

Two other McGraw-Hill editors will see the test but not cover it. Sid Kirkpatrick, editor of *Chemical & Metallurgical Engineering*, goes as one of the civilian technical observers. Donald Fink, executive editor of *Electronics*, is a member of the Navy party aboard the electronics control ship.

"Joint Army-Navy Task Force One," headed by Vice Admiral W. P. H. Blandy, is directing this "Operation Crossroads," which will involve the services of 35,000 men, mostly in uniform. These 100-odd target ships, only three or four of which are expected to sink, will be grouped in a carefully planned pattern at the west end of Bikini Atoll.

Two bombs are to be exploded this year. Early in July Bomb No. 1 will be dropped from a high plane to explode in the air. Bomb No. 2 will be set off at or near the water surface late in July.

Mr. Swain's reports will be written specifically for engineers, industrialists and business men. His own background for this assignment includes degrees in mechanical engineering, experience as a machinist, artillery officer and construction engineer, and extensive early studies in mathematics and physics. He has been active on the McGraw-Hill Atomic Energy Committee since its formation in August, 1945.

Calendar of Meetings

NATIONAL

International City Managers' Association, annual meeting, Montreal, Canada, June 16-21.

Society for the Promotion of Engineering Education, annual convention, Jefferson Hotel, St. Louis, Mo., June 20-23.

American Congress on Surveying and Mapping, annual meeting, Hotel Statler, Washington, D. C., June 28-29.

American Society for Testing Materials, 49th annual meeting, Hotel Statler, Buffalo, N. Y., June 24-28.

Society for Experimental Stress Analysis, spring meeting, Hotel Statler, Buffalo, N. Y., June 24-26.

Chinese Institute of Engineers, America Section, annual convention, Hotel New Yorker, New York, N. Y., June 29-July 1.

Associated General Contractors of America, Washington, D. C., spring governing and advisory board meeting, Sherley-Savoy Hotel, Denver, Colo., June 29-July 2.

American Society of Civil Engineers, 1946 summer convention, Davenport Hotel, Spokane, Wash., July 17-20.

REGIONAL

Ohio Conference on Sewage Treatment, Mayflower Hotel, Akron, Ohio, June 20-21.

Upper Peninsula Road Builders' Association, annual meeting, Houghton, Mich., June 24-25.

New Jersey Section, American Water Works Association, summer meeting, Little Falls, N. J., June 28.

Ninth Annual Short Course for water and sewage personnel, Louisiana State University, Baton Rouge, La., July 25-27.

American Shore and Beach Preservation Association, summer meeting, The Breakers, Cedar Point, Ohio, Aug. 15-17.

Bill authorizing $519 million rivers, harbors work approved by House

Many large projects, including $116,941,000 for the Lower Mississippi River, $71,000,000 for Columbia River and $55,000,000 for Arkansas Basin approved, but $82,300,000 Big Sandy job is out

A bill (H. R. 6407) authorizing the U. S. Army Engineers to carry out more than $519,000,000 worth of rivers and harbors work was passed by the House June 6. This action was taken but a few days after the measure had been reported out by the House Rivers and Harbors Committee (*ENR* May 30, vol. p. 833). Whether or not the Senate will act upon the bill—includes no appropriation—before the recess of Congress now planned for July is unknown.

Most important act of the House as a whole in passing the bill was deletion of the $82,300,000 project planned for the Big Sandy, Tug and Lelisa Fork Rivers in Kentucky, Virginia, and West Virginia. Elimination of this work resulted in a major reduction in the $601,725,070 grand total of work the House Rivers and Harbors Committee had approved.

The Big Sandy project calls for a channel 9 ft. deep and 150 ft. wide on Tug Fork to Sprigg, W. Va., and a similar channel on the Levisa Fork to Russel Fork, a tributary. Such a plan calls for construction of 10 locks and dams and extensive channel excavation. The locks would be 80 ft. wide and 500 ft. long, auxiliary locks also being provided.

Many large projects approved

Largest projects remaining in the bill as passed by the House are as follows: $116,941,000 for Tombigbee and Tennessee Waterway in Alabama and Tennessee; $71,000,000 for improvement to the Columbia River and Foster Creek in Washington; $73,361,000 Appalachicola, Chattahoochie and Flint rivers in Florida and Georgia; $55,000,000 Arkansas River and its tributaries, and $41,000,000 Red River and its tributaries in Louisiana.

The bill also authorizes the following work: Great Lakes connecting channels in Michigan, $28,063,000; Illinois Waterway and Grand Calumet River, Illinois and Indiana, $21,000,000; Cumberland River and its tributaries in Kentucky and Tennessee, $20,730,000; culm removal in the Schuylkill River in Pennsylvania, $12,895,000; and deep water channel in the Sacramento River, California, $10,742,000.

Still other large projects approved by the House are: the Texas-Louisiana Inter-Coastal Waterway, $8,000,000; improvements at Cleveland, Ohio, harbor, $11,677,000; Mermentau River and tributaries in Louisiana, $7,500,000; San Diego River and Mission Bay, Calif., $5,858,000; and Coos Bay, Oregon, $5,689,000.

Toledo plans three-step lake front development

Dredging operations necessary for construction of a $15,000,000 ore and coal dock at Toledo, Ohio, recently are the start on a plan for a $10,000,000 harbor and mooring basin development for the city.

Thomas Reeves, Toledo's harbors and bridges commissioner, said that dredging at the dock for the Lake Front Dock and Railroad Terminal Co. will result in removal of 1,500,000 cu.yds. of soil from the bottom of Maumee Bay. He submitted a 3-stage proposal that would utilize this material for construction in the center of the bay of a triangular island, and a mooring basin large enough to accommodate 80 vessels. First stage of the development would include construction of about half of the island and the basin.

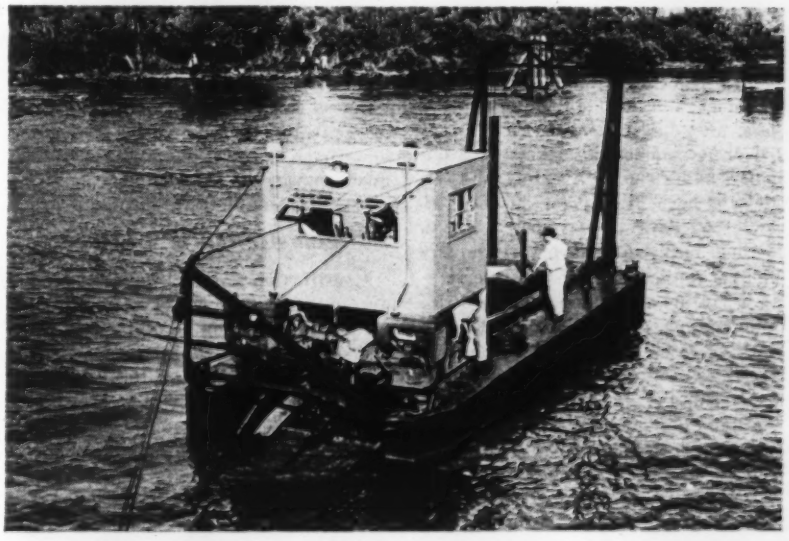
Ohio residents to continue opposition to Dillon Dam

Struggle of the Licking Valley Protective Association to prevent construction of the Dillon Dam, a $10,000,000 flood control reservoir on the Licking River five miles east of Zanesville, Ohio, (*ENR* Jan. 31, vol. p. 154) will be continued, spokesmen declared, after a recent special hearing called by Army Engineers at the request of Representative J. Harry McGregor.

The Licking Valley Protective Association is supporting its alternate plan to protect Zanesville from the recurrent floods on the Licking River by the construction of a series of 13 small dams on creeks flowing into it.

Although the Licking group has presented no definite estimate of the cost of this system, spokesmen contend that the $28,634,000 estimate made by the Army Engineers is too high. Among arguments against erection of the single Dillon Dam is the cost of relocating the Baltimore & Ohio Railroad track, set at $6 million, and the loss of $6,000,000 of property from the tax rolls—two-thirds of it in Muskingum County.

Dillon Dam was originally designed as a 15th reservoir of the Muskingum Conservancy District. It was omitted from the district because its cost would have taken too large a share of the $34 million appropriated for the job of cutting down disastrous floods on the Muskingum River and its tributaries. The Licking River enters the Muskingum at Zanesville.



***Baby Dredge**—Powered by a 100-hp, six-cylinder gasoline engine, this 22-ton hydraulic dredge was built by Higgins, Inc., New Orleans, La., for the Venezuelan government for rivers and harbor work. Carrying an 8-in. suction pipe, capable of cutting a channel 15 ft. deep, the dredge hull is 40-ft. x 16-ft. wide and is made of five watertight compartments bolted together.*

Offer premium plans to manufacturers of three builders' supply materials

Representatives of three building material industries met in Washington last week to consider proposed premium payment plans to speed the nation's housing program, authorized under the recently signed Emergency Housing Bill (*ENR* May 30, vol. p. 832).

Softwood-plywood, structural clay products and gypsum paper liner constitute the three industries for which the first proposed plans were prepared by National Housing Expediter Wilson W. Wyatt. All three programs would be retroactive to June 1.

The softwood-plywood plan proposes payment of premiums to plywood mills for increases in production in excess of designated quotas, to be established on the basis of production during selected months of 1946, prior to June. By making the plan retroactive to June 1, it is expected that incentives will be provided for immediate increases in shipments of peeler logs to plywood mills and a step-up in plywood production.

For the clay products industry, the plan calls for premiums to be paid to producers for output in excess of a quota designated for each plant, such quota to be based on the plant's production in selected months of 1946 prior to June; and the paper liner industry will consider a plan under which premiums would be paid to mills for increases in output over individual quotas.

The Civilian Production Administration, meanwhile, June 5 announced easing of its restrictions on softwood-plywood to allow a portion of the material to flow into additional essential civilian and military uses, and into veterans hospital construction.

Distributors must continue to set aside 75 percent of their softwood-plywood stock, but in addition to certified orders, they must honor any type of rated order against this reserve. Additionally, under the CPA ruling, the set-aside will be held only for 30 days, instead of 60 days as previously. Up to this time, only certified, or HH, orders could be applied against the reserve.

In a parallel action, the Office of Price Administration granted across-the-board price increases on western pine and Douglas fir railroad ties to producers. Effective June 11, the action raises prices of western pine ties by $4.50 per thousand board feet, Douglas fir crossties by $5.50 and fir switch ties by $4.50.

LUMBER UNDER COMPLETE CONTROL

Production of every sawmill in the United States, regardless of size and output, was brought under government control by the CPA June 6, in an effort to boost housing construction lumber and flooring reserves by more than 4½ billion feet. The action was effected by amendment of Direction 1 of Priorities Regulation 33.

Previously, CPA had only controlled those sawmills producing 8,000 ft. of softwood or 4,000 ft. of hardwood daily. CPA said the action, by increasing the amount of each mill's reserve and cutting military rated orders, will increase the total reserve to the desired figure.

Local Housing Activities

Provision of several thousand emergency homes for veterans under the authority of the Chicago, Ill., Housing Authority, came to an abrupt halt June 6, when city officials balked at advancing further funds for the work. Construction of 3,406 temporary dwelling units has been under way.

The city had already advanced $2,000,000 for the work, on the apparent assumption that the city would be reimbursed by the federal government for its investment in the work. Discovery that federal agencies had no means of repaying the city brought refusal by city officials to continue advances to the housing authority, which cannot repay the city. Most of the housing is barely past the ground clearing stage.

Meanwhile, other agencies and private builders were proceeding with housing plans of their own that began to show evidence of being a real solution to the current housing problem.

In Cleveland, Ohio, a newspaper survey showed that in the city itself, and its 15 major suburbs, a total of 2,000 new homes, valued at about $18,000,000 are already under construction.

At Honolulu, T. H., 84 war veterans announced they had pooled their interests, bought a 14½-acre plot near Honolulu, and plan to build homes for each of the members of the group within the near future. Total cost of the lot and a two-bedroom home in this project is estimated at less than $10,000.

In St. Louis, Mo., Allen Young announced he would build a Veterans' Village composed of junked double-decked motor buses just outside the city limits. Young recently purchased 34 such buses from a local auto-wrecking company, and plans to mount them on concrete foundations for sale at about $1350 each.

Also in St. Louis, the board of Aldermen considered a bill that would authorize a sale of lots acquired by the city for taxes, for use in providing about 200 home sites for veterans. The measure would authorize the board of estimate and apportionment to sell the lots for not less than 50 percent of the assessed valuation, to contractors and builders for construction of veteran's homes to cost not more than $6,500.

Senate group favors St. Lawrence pact

(*Continued from page* 85)

was written, which have drafts in salt water of 28 ft., 7 in. and 27 ft., 9 in. respectively. However, the committee found that the 27-ft. depth would be adequate in view of the fact that ships are seldom loaded to their maximum draft.

Estimated cost of new work

Construction work called for under the agreement will cost $455,086,000, according to estimates of the Army Engineers. Of this amount, the United States is required to provide $310,270,000 and Canada $144,812,000. A breakdown of these figures was published in *ENR* March 7, vol. p. 325. The committee reported that opponents of the project put the cost as high as $1,450,000,000.

Power is to be generated in a single drop of about 100 ft. in a plant of 2,200,000 hp. capacity, built across the international boundary so that half the generating equipment can be located in Ontario and half in New York. It is estimated that this equipment can be installed at a cost of $89 per hp as compared with $90 Boulder Dam.

Under an agreement between the federal government and New York State signed Feb. 7, 1933 and revised in February of this year, New York state will take over the power plant on this side of the border to be operated by the New York State Power Authority pay the federal government $98,057,250.

Canada will install the generating equipment on the Canadian side.

Waterway benefits

The committee heard arguments for and against the waterway but concluded that it will produce savings ranging from $1.50 to $12 a ton. Operating costs were set at $10,000,000 per year or at about $1 per ton of estimated freight.

Under the provisions of the joint resolution, the President is directed to make a study of the possibility for making the seaway self-liquidating through tolls on foreign commerce.

May construction set at $814 million

Total new construction put in place during May—then largely unaffected by setbacks caused by the coal strike—was valued at $814,000,000, according to the Construction Division of the Department of Commerce.

The May dollar volume represented an increase of about 15 percent over that of April, and 109 percent over May, 1945. All types of construction during May, following normal seasonal trends, showed increases over April.

Engineering News-Record's own figures, based, however, on contracts let rather than on construction put in place, show a parallel increase (*ENR* May 23, vol. p. 813).

Privately-financed residential construction, excluding farm buildings, trailers and conversions, was valued at $290,000,000 during May, the department of commerce said. This was an increase of 16 percent over dollar volume in April of 1946, and six times the figure of May, 1945.

The report said that the value of all types of privately-financed construction during May was $683,000,000—an increase of 14 percent over April, and about 282 percent over that of May a year ago.

The Commerce Report noted that during the month, about $40,000,000 was spent for highway construction—the largest single expenditure in publicly financed construction. This figure was a 21 percent increase over April volume, and reflected normal seasonal expansion in highway construction activity.

New scarcity list

While construction figures continue to mount, the materials shortage situation showed few signs of easing.

The Civilian Production Administration made public a revised list of critically scarce products, the producers of which may be granted urgency certificates to purchase surplus equipment from the war assets administration. The certificates, described in Direction 16 to Priorities Regulation 13, give the holders precedence over any other class of buyers on WAA stocks of surplus equipment.

Recent additions to the schedule of critical products are: asbestos-cement shingles and flat sheets; asbestos-cement siding and flat sheet specialized machinery; asphalt and tarred roofing products; asphalt and tarred roofing products specialized machinery; warm air furnaces; gypsum board and lath; gypsum board and lath specialized machinery; certain types of plumbing fixtures; lead, and convector radiation.

Already included on the CPA's scarcity list are: clay building products; malleable and grey iron castings, including cast iron soil pipe, cast iron radiation, and railroad car brake shoes; lumber; concrete building products, resin and electrical high-silicon sheet steel.

Columbia River resources studied by U.S.-Canada

Investigations of the resources of the Columbia River in British Columbia by the International Joint Commission is planned for this year. Facts and recommendations will be reported to the Canadian and United States governments. Total cost of these investigations is expected to be around $750,000 in Canada and $4,000,000 in the United States.

Valley authority hearings set

Hearings are tentatively scheduled for June 25-28, 1946, in Washington, D. C., before a subcommittee of the Senate Committee on Commerce on S.1716, to establish a Columbia Valley Authority. Proponents of the bill will be heard on the first two days, and opponents on the last two days. Representatives of the government departments will not be heard during these hearings but may be called to testify at a subsequent hearing.

All organizations concerned with any phase of land or water conservation, development or improvement have been urged to adopt resolutions and forward them as soon as possible to Senator John H. Overton, Chairman, Senate Commerce Subcommittee, Washington 25, D. C.

Hangars of 275-ft. span have shell on arch axis

American Airlines is starting construction of two 275-ft. span thin-barrel arch concrete hangars 175-ft. deep in a connected structure that has a 3-story office building along the street side at the Chicago airport.

The hangar structure was designed by Ammann and Whitney (O. H. Ammann, New York, and C. S. Whitney of Milwaukee) with Aymar Embury III as architect. The arch barrel will be placed on the neutral axis of ribs 48 in. deep and 18 to 20 in. wide. Plans are to use "radiant heating" for the hangar with pipes laid in the concrete floor.

Estimated cost of the improvement, with aprons and auxiliary facilities, is $3,000,000. Corbetta Construction Co. of New York is the general contractor.

Chicago fire shows need for proper design

Fifty-nine deaths in "fireproof" structure focus attention on design features that permitted spread of flames.

Fifty-nine deaths and more than 200 other casualties caused by a fire in the La Salle Hotel in downtown Chicago, Ill., soon after midnight on the morning of June 5 have focused attention on design features which permitted rapid spread of flames and hot gases. Preliminary reports indicated that the hotel had complied with all city fire regulations.

Rapid ascent of heated gases and smoke is attributed to two open stairways extending from the lobby to the 20th floor. Two outside fire escapes furnished the only safe exits for people trapped on the upper floors. Three enclosed stairways were available.

Enclosure of all stairways in hotels is required by the present city building code, but no such requirement existed when the La Salle was built in 1908-9. The requirement was not made retroactive when the present code was adopted.

Although cause of the blaze still remains a mystery, best available evidence is that it started in a cocktail bar on the ground floor. Flames spread quickly to adjacent elevator shafts in the lobby and through the lobby itself, sending clouds of smoke and gases up the open stairway to higher floors. Three enclosed stairways, two from the 20th to the second floor and one from the 20th to the lobby, were of little use for escape.

The 22-story, 1,000-room hotel was designed as a fireproof structure of structural steel and concrete, with Bedford limestone and brick facing. The fire caused extensive damage to the first five floors.

Engineers listed among those who lost their lives in the fire include: James O. Potter, city engineer of Quincy, Ill.; C. Emery Salisstrom, head of the Quincy Federal Housing Authority; Perry W. Swern, Chicago architect; Maj. Walter R. Reiman, of the U. S. Public Health Service, Little Rock, Ark.; and Brice McBride, regional engineer for the Fish and Wild Life Service of the U. S. Department of the Interior, with offices at Provo, Utah.

Seven investigations have been started to determine the cause of the fire and any possibility of criminal negligence, including a coroner's jury which has five engineers among its members, and a five-man committee appointed by Mayor E. J. Kelly to investigate the blaze. This committee includes Frank A. Randall, structural engineer, and Alfred Shaw, architect.

Phoenix, Ariz., studies major water expansion

Drouth possibility spurs consideration of $10 million program to provide adequate supply to capital city

Alarmed by a continuing low runoff in its single dependable drinking water supply, and mindful of rapidly mounting demand, Phoenix, Ariz., city officials last week were considering engineers' proposals for an eventual $10,000,000 expenditure to assure safe supplies.

The proposal—a 20-year, 2-stage development—was submitted to Mayor Ray Busey by the Kansas City engineering firm of Burns and McDonnell, and called for immediate development of new well fields, construction of a new pumping station, and changes in the city's distribution system, based on the assumption that the city's present population of about 70,000 will more than double by the year 1965.

For the past six months, flow in the Verde River—from which the city draws its principal supplies—has been about 50 percent of normal, the engineers reported. Similar low runoff in other Arizona streams has already brought out the possibility of irrigation losses and decrease in power output of the state's hydro-electric installations (*ENR* April 18, vol. p. 529). Meanwhile, officials were told, the city's present distribution system is capable of delivering 30 mgd., while demand has hit a peak hourly rate equivalent to 59 mgd. Result has been main pressures of less than 25 pounds, insufficient to get water above the first floor in downtown business buildings.

First half of the program—recommended for immediate action at a cost of about $5,929,000—would include drilling of 18 new wells in the Queena Harry well field north of Fort McDowell on the Verde, installation of new lines from the well field to city reservoirs, improvement of the distribution system, and construction of a 30 mg. reservoir and a pumping station at the edge of the city.

As a preliminary step to undertaking the program recommended, engineers urged an immediate agreement with the Salt River Valley Water Users Assn.—principal irrigation project in the area—for more equitable distribution of Verde River water between the city and irrigators in the surrounding territory.

The recommendations took into consideration the probability that the Bureau of Reclamation will proceed with its plans to divert water from the Colorado River (*ENR* Aug. 2, 1945, vol. p. 131) and construction, under this scheme, of a dam at Fort McDowell, just above the city's well-fields. The report suggested, however, that the proposed McDowell Dam should not be considered as a source of city water under the present program.

Mayor Busey appointed a 5-man committee to aid city officials in making a survey of the city's financial ability to construct the improvements.

Ready to construct third step of Ross Dam

Progress on Seattle's Skagit River power project was indicated by a recent announcement by E. R. Hoffman, city light superintendent, that application will be made shortly to the Federal Power Commission for permission to construct the third step of its giant Ross Dam.

When completed, the additional step will boost total water storage facilities to 1,400,000 acre-ft., a jump of 724,000 acre-ft. above the total storage capacity of 676,000 acre-ft. when the second step of the dam is finished. This is slated for about next March. In its final form the dam will be 545 ft. above the river bed when the final 70 ft. is built atop the second step. The $10,000,000 first step, completed in 1940, provided about 100,000 acre-ft. of storage.

Construction of the two power tunnels, now at the half-way mark, must be completed before concrete-pouring in dam construction can commence. The tunnels, some 27 ft. in diameter and 900 ft. in length, will carry water to the turbines.

Contract is let for new Hyperion outfall tube

Award of a $3,517,410 contract for a new submarine outfall tube near Los Angeles, Calif., was made May 27 by the board of public works to Guy F. Atkinson Co. as an initial step toward solution of the city's sewage disposal problems. (*ENR* Feb. 21, p. 58).

Although the bid-opening had taken place last January, award had been delayed for further study of the city's plans by consulting engineers.

The work will involve construction and installation of pipe 12 ft. in diameter from a proposed new $21,000,000 treatment plant at Hyperion to a point approximately one mile into the Pacific Ocean.

To be partly financed by municipal funds, and partly through a portion of the $13,084,059 in funds recently earmarked by the state legislature for such projects, the outfall will replace a faulty tube now emptying into the ocean. The state health department had called this outlet a source of contamination to nearby beaches.

Hawaii tidal wave damage overestimated

Hawaii, still estimating the cost of its April 1 tidal wave disaster, found figures scaled far downward.

With virtually all lumber needs growing out of the tidal wave satisfied, only 7,583,318 bd. ft. was allocated out of a stockpile of 13,500,000 bd. ft. made available by the Army and Navy.

Requests for federal aid to rehabilitate Hilo were scaled from $50,000,000 to a maximum of $20,900,000.

Items in the present federal request include: $10,000,000 for roads including damages during the war by heavy Army and Navy traffic; $1,300,000 for piers, sewage and water systems; $5,000,000 for small loans for rebuilding homes and businesses; $2,000,000 for emergency dwellings; and $1,600,000 for developments of a harbor at Kawaihae on the island of Hawaii.

San Diego, Calif., begins big playground project

Plans are under way and work has commenced on a $14,680,000 project to transform Mission Bay into playground areas, according to W. E. Schwob, assistant engineer of the San Diego, Calif., planning department.

Nearly 5,000 acres of shallow bay lying northwest of San Diego will be dredged to deepen channels and to create numerous small islands, beaches, yacht basins and lagoons to be devoted exclusively to recreational purposes.

Additional encouragement was given to the plan when the Congressional Rivers and Harbors Committee approved spending more than $5,000,000 for flood control of San Diego River, which empties into Mission Bay, and for navigational development. Under the Rivers and Harbors bill, the government proposes to build three jetties out into the ocean and create two channel entrances through the present mouth of Mission Bay. One of these channels would be for the flood control of San Diego River, while the other channel would be deepened to provide a safe entrance into Mission Bay for ocean-going and pleasure craft.

Meanwhile, the city of San Diego is proceeding to deepen Mission Bay and to develop the recreational facilities of this area on its own.

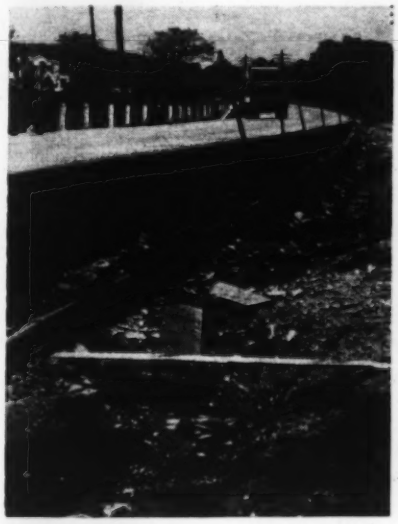
Nearly 26,000,000 cu. yds. of dredging will be required to complete the project. Since the first of the year one small dredge has moved into the location and since March 1 approximately 800,000 cu. yds. have been dredged in the first phase of the project.

N. Y., Pennsylvania floods recede at rapid pace

Flood waters that roared through southern "upstate" New York and northeastern Pennsylvania June 3-5 (*ENR* June 6, vol. p. 881), subsided quickly last week, leaving little further damage.

The high waters in the New York State area ran off into Pennsylvania rivers, forcing quick rises in the Schuylkill and Delaware rivers and their tributaries, causing some additional damage and several deaths. Most of the damage —as in the earlier floods—was incurred by railroad structures and highways bordering the rivers.

In Philadelphia, two of the city's water stations were flooded, and the engine room of the city's aquarium was put out of commission. The high runoff in the Delaware, coupled with tidal rises in the river, backed up sewer system outfalls to complicate the city's problems. Pennsylvania highway engineers estimated the state's loss at $1,000,000 and state highway departments and private industry made quick moves to repair washouts and restore normal traffic.



ENR staff photos

Typical of pavement damage in New York is serious washing of U. S. 15 near Presho, N. Y., (above) where the pavement had been raised above "possible floods." The double-track main lines of the Delaware, Lackwanna and Western and the Erie railroads suffered minor damage a few miles east of Corning, N. Y. (top, right) while the Erie lost three 150-ft. through spans nearer Corning. Subsidence of a pier caused serious breaks in two spans of a concrete bridge at Williamsport, Pa., while (bottom) a Pennsylvania RR locomotive almost reached the safety of a bridge span before the approach fill gave way, near Williamsport.

"Bids too high" still general trend

Soaring building costs, it is reported from Minneapolis, Minn., apparently will force another 15 to 20 percent increase in Minnesota's appropriations for new state buildings authorized but not yet erected.

Oliver Van Krevelen, state budget engineer, says that although the 1945 legislature added $1,253,600 to prior appropriations, the only solution will be to ask the 1947 legislature for further increases.

Bids too high in Oregon

On two road projects on which bids were called for May 28 at Portland, Ore., by the Oregon Highway Commission, no bids were received on one project and the lone bid received on the other was rejected as too high.

The bid rejected was that of Leonard & Slate of Portland, $260,596 for grading of the Warm Springs highway in Wasco County. The project on which no bids were received was grading, surfacing and bituminous surfacing of the Klamath Falls-Lakeview highway in Lake County.

The Oregon highway commission has rejected a low bid for construction of a bridge in Wasco County because the Public Roads Administration refused approval in view of the steel shortage.

Low bidder, at $274,767, was Kern & Kibbe of Portland, Ore. The contract called for construction of a 300-ft. steel arch span, with a 120-ft. steel viaduct approach at each end, over Mill Creek on the Warm Springs highway.

Davis Dam highway bids rejected

The Arizona Highway Commission recently rejected all bids for construction of the Kingman-Davis Dam highway because they were considered excessive.

The low bidder was the Utah Construction Co., which submitted an offer of $267,122 for construction of the 27-mile highway linking the $77,000,000 Davis Dam project with its railhead center at Kingman.

The commission announced the Utah Construction Co.'s bid was 29.4 per cent above state engineering estimates.

W. C. Lefebvre, state engineer, advised the commission that as a general rule, he will not recommend to it the awarding of any road contract upon which the low bid is 10 percent in excess of the state's engineering estimates.

The Kingman-Davis Dam job will immediately be readvertised for new bids.

At Enid, Okla., the Cowen Construction Co. of Shawnee, made the only bid on a projected high school building of $1,514,729, a figure far beyond the available funds for replacement of a building which was destroyed by fire in September, 1943.

Contrary to the nationwide trend, road contractors' bids in Idaho on improvement of 195 miles of state highway recently ran $106,500 below estimates for the work. According to T. Matt Hally, public works commissioner, the total in bids was approximately $532,000, compared to $638,500 as estimates by highway department engineers.

Chicago voters approve large bond issues

By a margin of 3 to 2, six bond issues totaling $115,660,000 were approved in an election held in Chicago on June 3. At the same time a $70,000,000 bond issue was approved for the construction of super-highways in Cook County, Ill. The county bond issue passed by the relatively narrow margin of 189,000 votes for it and 168,000 votes against it. All six of the city bond issues will be new corporate bonds to be retired by property taxes. Funds derived from the sale of these bonds, when issued, will be combined with funds authorized by previous corporate bond issues, revenue bonds and current revenues from motor fuel tax to launch Chicago's seven-year public works program (*ENR*, April 18, 1946 vol. p. 532).

The largest single bond issue approved at the election was for $58,160,000 worth of new sewers and sewer extensions proposed in the city's over-all sewer program (*ENR*, Mar. 22, 194[illegible] vol. p. 382).

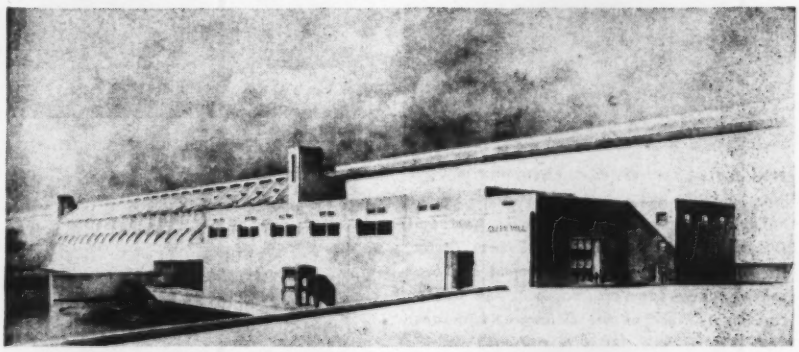
Next in size was a bond issue of $4[illegible]000,000 to be applied toward the city's one-third share of the $205,000,000 superhighway program planned for the entire Chicago area and to be financed jointly by the city, county and state.

The four other city bond issues include: $8,000,000 for street and alley repairs and resurfacing; $5,000,000 for additional street lighting; $500,000 for the construction of city garages; and $2,000,000 for new playgrounds. These playgrounds are in addition to a previously authorized $24,000,000 improvement program of the Chicago Park District.

The $70,000,000 county bond issue will be used to finance the county's share in the following highway construction: Northwest superhighway, $23,600,000; feeder route to the northwest superhighway, $666,700; extension of Wacker Drive south to an interchange plaza to be built as part of the Congress Street expressway, $4,166,700; Congress Street expressway, $31,500,000; south superhighway and Calumet parkway, $7,066,000; and the tri-state highway, $3,000,000.

Cartersville, Ga.—Formal dedication of the construction of the Allatoona Dam and reservoir near Cartersville, Ga., (*ENR* March 7, vol. p. 331) will take place June 15 when Gov. Ellis Arnall of Georgia will welcome Lt. Gen. Raymond A. Wheeler, Chief of Engineers, at elaborate ceremonies.

The huge flood control and power development project is under construction by the Corps of Engineers and is supervised by the Mobile, Ala., office.



***Prepare Plans for Georgia Dam**—Plans for the $40,000,000 Clark Hill Dam, to be built by the Corps of Engineers on the Savannah River 5 mi. above Augusta, Ga., are being prepared by Chas. T. Main, Inc., of Boston, Mass., under immediate supervision of R. T. Colburn. Dam will be 200-ft. high and 5,670-ft. long. Twenty-three spillway gates, 40 x 35 ft., and six spillway sluices will be provided. The huge power plant is being planned for an ultimate installation of seven 40,000-kw. generating units.*

OBITUARY

D. Norman Turner, 54, a civil engineer employed by the Bell Telephone Co., with which he was associated for 25 years, died May 24 at Philadelphia, Pa. He was a graduate of the University of Pennsylvania.

Charles C. Mummer, 79, for 50 years a contractor at Alliance, Ohio, died May 30 in Toledo.

William Fritz Wright, 54, of Wright & Lopez, contractors, died May 24 at Cedartown, Ga. A graduate of Clemson College, Clemson, S. C., he served overseas as a first lieutenant in the 106th Engineers Dixie Division.

Noel H. Hick, 62, who as a member of The Austin Co.'s Cleveland, Ohio, district engineering staff since 1934 was active in a number of important war projects, died May 24. He was in charge of the location survey for the Dow Chemical Co. in 1939 which led to the selection of Freeport, Tex., as the site of the world's first plant for the production of magnesium from sea water. Subsequently, he served as project manager for the controlled-conditions Naval Ordnance Plant at Indianapolis, Ind., for the manufacture of Norden bomb-sights and other precision fire control instruments. He also served as project manager during the concluding stages on the work at Bell Aircraft Corp.'s plant at Niagara Falls, N. Y. At the time of his death he was project engineer on a plant for the Norwich Pharmaceutical Co. at Norwich, N. Y. A graduate of Case School of Applied Science, Mr. Hick had been engaged in engineering at Cleveland since 1905.

Glover Fitzhugh Perin, 76, an engineer associated for the last 25 years with the Gulf Oil Corp., died in Philadelphia, Pa., recently. Before that he had been active on public works projects.

Rodney L. Stewart, 65, civil engineer and contractor died at Easton, Pa. on June 3. He was a graduate of Lafayette College in 1903. He had been associated at various times with the Edison Portland Cement Co., the Stewart Contracting Co., Philadelphia Salt Manufacturing Co. and the Armstrong Latta Co.

George Edwin Hamlin, 71, retired deputy state highway commissioner of Connecticut died June 4 at Hartford. He began his engineering career in 1902 and was with the United States Engineering Corps until 1909, when he joined the State Highway Department. He served as deputy highway commissioner for ten years preceding his retirement in 1939. He was a former president of the Connecticut Society of Civil Engineers.

Vincent Macaluso, 58, for the last 10 years vice-president of the Tuxedo Park, N.Y. Association, and formerly an engineer for Parsons, Brinckerhoff, Hogan & MacDonald, New York City, died June 5. He was a graduate of Brooklyn Polytechnic Institute, and had worked on the Detroit, Mich., tunnel and on the Scheldt River project in Antwerp, Belgium.

Henry C. Porter, 60, an engineer for the Texas State Highway Department for the past 25 years, died at Austin, May 31. He was recently the recipient of the department's certificate of honor for meritorious service, in recognition of his work as head of research on foundations and soil mechanics.

Big graphic arts center planned for N. Y. City

To cost about $20,000,000, and to cover an area of about four acres, with a content of more than 40,000,000 cu. ft., the new Graphic Arts Center, planned for construction in midtown Manhattan, will serve printing, lithographic and allied industries.

In plan, the building will be about 267 ft. by about 722 ft., and it will be 13 stories high. Designed for a live load of 350 psf. throughout, to support the heaviest types of presses, typical floors will have an area of 163,260 sq. ft. Floor bays will have a minimum width of 25 ft. Floors will be concrete, the frame steel, and the exterior brick and stone.

The structure is being designed by Francisco & Jacobus, architects, and will be built by Thompson-Starrett Co., for Nordblom Associates, Inc., realtors, all of New York City.

Moreell is nominated to 4-star rank

On June 7 President Truman nominated Vice Admiral Ben Moreell, Chief of the Navy's Materials Branch, and at present federal operator of the soft coal mines, (*ENR* May 30, vol. p. 830) for promotion to the rank of full admiral on a temporary basis.

If this nomination is approved by the Senate, Moreell will be the first staff officer to become a full 4-star admiral, although many line officers have been advanced to that rank. However, he will be the first man of either line or staff duty not a graduate of the U. S. Naval Academy at Annapolis to reach the rank of full admiral.

CONSTRUCTION ACTIVITY

As Reported this week to ...
Engineering News-Record

CONTRACT VOLUME

Continental U. S. Only (Thousands of Dollars)

	Week of June 13 1946	Cumulative 1946 (24 wks.)	Cumulative 1945 (24 wks.)
Federal	$22,702	$280,212	$453,886
State & Mun.	29,842	581,829	109,692
Total Public	$52,544	$862,041	$563,578
Total Private	86,367	1,535,755	224,164
U. S. Total	$138,911	$2,397,796	$787,742

WHERE CONSTRUCTION ACTIVITY ORIGINATED THIS WEEK

Dollar Volume (Thousands)

Type of Work	This Week	Cumulative 1946 (24 wks.)	Cumulative 1945 (24 wks.)
Waterworks	$1,398	$43,721	$18,073
Sewerage	7,105	42,198	13,141
Bridges	3,009	55,483	11,807
Highways	16,539	330,360	79,213
Earthwork, Waterways	13,085	171,831	16,330
Buildings, Public	7,655	145,956	292,602
Industrial	13,632	492,040	156,235
Commercial	60,741	938,795	38,110
Unclassified	15,747	177,412	162,231

NOTE: Minimum size projects included are: Waterworks and waterway projects, $22,500; other public works, $40,000; industrial buildings, $55,000; other buildings, $205,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1946 (24 wks.)	Cumulative 1945 (24 wks.)
NON-FEDERAL	$478,844	$271,879
Corporate Securities	189,395	76,180
State and Municipal	289,449	174,799
RFC Loans	.....	20,900
FEDERAL	158,320	251,010
Total Capital	637,164	522,889

ENR INDEX NUMBERS

Index Base = 100		1913	1926
Construction Cost	June '46	347.91	167.24
Building Cost	June '46	264.16	142.80
Volume	May '46	284	125

EDITORIALS

VOLUME 136 NUMBER 24

June 13, 1946

The Wrong Approach

PROSPECTS FOR SOUND clean-stream legislation in this session of Congress are not promising even though a so-called "compromise" bill has been introduced by the House Rivers and Harbors Committee. That the new measure is no compromise in the accepted definition of the term is shown by comparison with the original bills. This comparison (p. 132) indicates not only a negative response to important testimony given at hearings on the original bills, but also a seeming determination on the part of the committee to discount the interests and achievements of state and inter-state agencies in stream pollution abatement. At least that must be the interpretation in shifting from enforcement and control at the state level toward absolute control by federal authority; and it is difficult to understand why representatives of the state, municipal and industrial interests are given no place on the advisory board, which will guide nationwide policies. These are but the main points of contention over the bill which, however good in overall intention, appears in method and procedure to fall far short of a sound and workable instrument for pollution abatement.

Inflammable Contents

UNTIL THE REPORTS of official investigations are rendered, any appraisal of the significance to building design of th tragic fire in Chicago's "fireproof" LaSalle Hotel must be regarded as tentative. Yet the various news accounts indicate, if not definite conclusions, at least some directions which investigations and studies should take. The chimney effect of open stair wells and elevator shafts is well known. Modern fire ordinances prohibit open stair wells in new buildings, but seldom require corrective construction in existing structure. The LaSalle fire suggests that this policy needs review, the more so since it is in older buildings that such things as wornout electric wiring, obsolete heating plants, etc., are most apt to be points of origin for fire. The Chicago experience illustrates another hazard present in many old buildings and some new ones —the extensive use of wood paneling which varnish or countless applications of wax and polishing oil has rendered inflammable almost to the point of explosibility. Fire prevention experts have repeatedly pointed out the fiction inherent in assuming a fireproof buildings in which furniture, fixtures and furnishings can readily burn. The aftermath of the LaSalle fire should be a thorough study of the possibilities of reducing the inflammable contents of our building by greater use of flameproof fabrics, fire retardant wood and non-fire-spreading materials such as steel, concrete, aluminum, gypsum and perhaps some plastics. Engineers and architects who know the potentialities of such materials should take an active part in these studies.

In Case You Missed It

A ROAD SIGN ARTICLE, "You Can't Miss It," in the May 11 *Saturday Evening Post* has many of the country's "road marker placers" countering with the statement "It couldn't have happened in my district." Yet there is ample evidence that road signing in the U. S. is too often inadequate, and in many places requires improvement. It would not be amiss for those responsible for road signs to take a vacation—a long motor travel vacation on which they could objectively study the needs of the motorist who does not know the road. Such a trip might give them a much better appreciation of the fact that a motorist needs signs, readable at 50 mph. far enough ahead of an intersection that he knows what he is going to do before he arrives at the intersection. Road safety depends greatly on proper road signing.

Roads of Friendship

REPRESENTING sixteen Latin American nations, 22 graduate civil engineers are now in this country attending a highway training course that promises much in international relations. Sponsored by the American Road Builders Association with the co-operation of four federal agencies, the course aims to acquaint the visiting engineers with our highway design principles, construction methods and application of equipment. Lasting nearly a year, the program includes lectures on fundamentals, inspection of highway departments, projects and equipment plants, and individual assignments to contractors, government departments and manufacturers, according to personal choice of the delegates. Then the visitors will return to their respective countries to assume important roles in highway design and construction. These men, carefully selected on the

basis of character and ability, will be in a position to incorporate American methods, materials and equipment with Latin American roadbuilding. In this connection it should not be forgotten that the progress now seen on the Pan-American Highway —originally called the "Road of Friendship"—had its inspiration in a several weeks' tour in 1922 by road engineers from Latin America. Aside from sanitation, no need is greater in Latin America today than transportation facilities. If that tour of several weeks in 1922 laid the groundwork for the Pan-American Highway, the present training course should have an even more profound influence in creating new "roads of friendship." Judged on its possibilities such a training course is worth continuing.

Engineering for Foreign Governments

CONGRESS has before it a bill (H.R. 4982) that superficially appears to relate only to activities of the State Department, but which has provisions of interest to many engineers. Introduced by Representative Bloom, the bill is designed to aid the State Department in developing better relations between this country and foreign nations. Its objectives are laudable, but some of its provisions appear to be much too broad, especially those relating to the exchange of "persons, knowledge and skills."

Section 7(c) authorizes any federal department or agency "to perform technical services for the government of another country desirous of obtaining such services as are within the scope of the established functions of the department, agency or independent establishment, and under terms and conditions which are satisfactory to the head of the department, agency or independent establishment, when it is determined by the Secretary that such services will contribute to this act."

The bill also amends and amplifies earlier legislation under which government employees having special qualifications can be loaned to "American republics and the Philippines," making it possible to loan specialists to all countries.

There is no doubt but that federal agencies like the Bureau of Reclamation or the Forest Service have men who have developed such special skills that their services would be of value to foreign nations. There is much to be said in favor of loaning such men as special advisers, provided the foreign government bears the full cost.

It also is true that some of our federal agencies have unusual research facilities such as those of the Waterways Experiment Station at Vicksburg and the Denver Laboratory of the Bureau of Reclamation that are not available elsewhere. Few people would object to letting federal agencies contract with foreign governments for special research that could be done only in these laboratories.

Research involving the use of unique facilities, however, is quite different from taking on design work that could be done by private practitioners. Acceptance of such design work would place a federal bureau in direct competition with taxpayers.

A better arrangement, when a country appeals to our State Department for assistance, would be for our government to grant leaves of absence to departmental specialists so that they could undertake the work as independent practitioners. Such a plan would free our government of all financial responsibility, and it would place responsibility for the design of the project squarely on the individuals who undertook the work. It would also be more in line with long established American concepts of business enterprise than is the practice of commercial contracts between governments.

One of the Bloom bill's major defects lies in the fact that it appears to be a thinly veiled invitation to foreign governments to ask us to do their engineering work for them under circumstances in which part of the cost can be placed on our government. This makes it easy for them to ask, and difficult for our federal bureaus to refuse without offense. Consequently, the sections of the bill relating to the loan of men of peculiar skills and the use of technical facilities of federal bureaus might harm rather than improve international relations.

This condition can be corrected by eliminating the section authorizing the use of federal bureaus, and by revising the section relating to the loan of personnel to make it clear that the government to which they are loaned must pay all their expenses. Charity does not improve international relations any more than it does personal relations. Moreover, such relations, insofar as the United States is concerned, are on a more logical basis if its individual citizens rather than its government carry on international business.

ENGINEERING NEWS-RECORD
Copyright, 1946, by McGraw-Hill Publishing Company, Inc.
WALDO G. BOWMAN, *Editor*. EDWARD J. CLEARY, *Executive Editor*.
New York: V. T. BOUGHTON, H. W. HUNT, E. R. DENMARK, E. E. HALMOS, JR., T. D. MacGREGOR, H. P. ORLAND and F. S. MERRITT. *Chicago:* V. B. SMITH, J. R. CARR. *Washington:* A. N. CARTER. *San Francisco:* N. A. BOWERS
EDITORIAL OFFICES: 330 WEST FORTY-SECOND STREET, NEW YORK, N. Y.

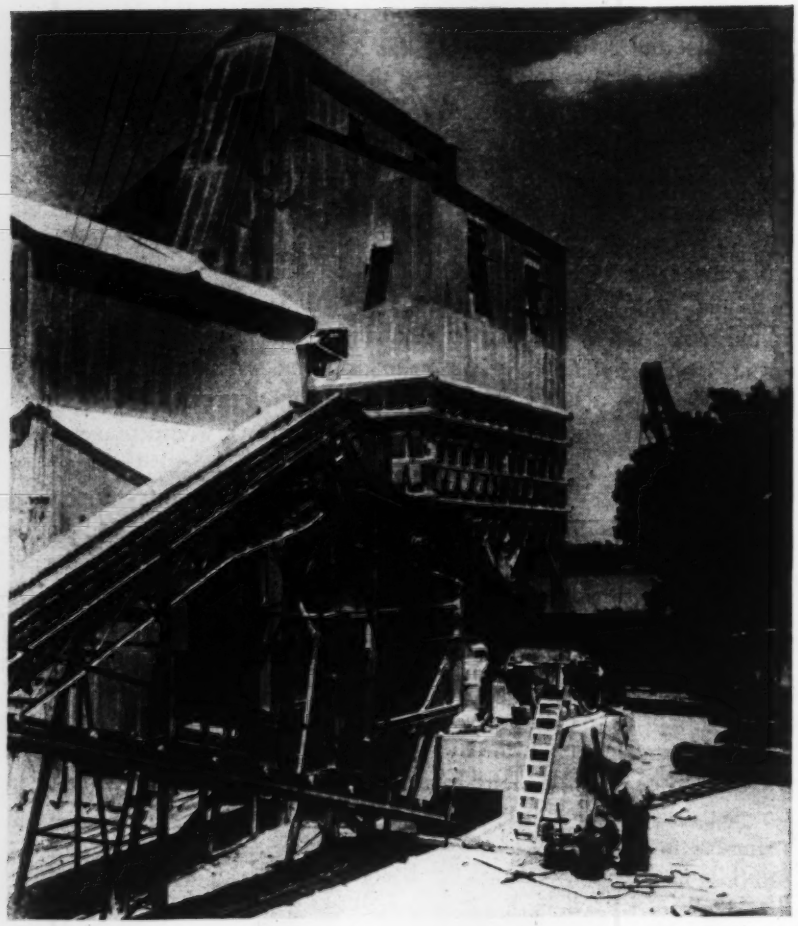


Fig. 1. Electric powered equipment produces stone riprap with a minimum of hand labor at a rock quarry.

One-Man Stone Riprap Made in a Primary Crusher

***Contents in Brief**—One-man stone riprap weighing up to 175 lb. each is produced by mechanical crushing at a rock quarry near St. Louis on the Mississippi River. An improved primary rock crusher, a special conveyor and a job-made screen reduce the amount of hand labor needed to produce the riprap.*

DESPITE occasional improvements in methods of revetting river banks for flood control such as the flexible concrete mattress developed by the U. S. Army Engineers (*ENR*, Sept. 20, 1945, vol. p. 390), the ubiquitous "one-man" stone riprap continues to be a major item in most projects involving stream control or bank protection. In view of the millions of yards of such riprap used each year, improved methods of production are of paramount importance.

The problem of volume production of satisfactory one-man stone riprap has been solved at a large quarry located on the Mississippi River, 11 miles below St. Louis, by modifying standard rock crushing equipment to produce the stone using a minimum amount of hand labor and a maximum of mechanical operation. The plant is owned by the Bussen Quarries, of St. Louis. It has been producing crushed stone for the past 20 years but only within the past two years was it converted to the production of one-man sized stone weighing from 25 to 175 lb. each.

Limestone rock secured from a tunneled quarry at the plant, and from an open quarry nearby, is reduced to one-man riprap in a stationary 25 x 40-in. primary jaw crusher. The crusher is mounted in a concrete walled pit with the intake hopper placed at ground level to facilitate dumping of the quarried rock from trucks. It is powered by a 100-hp. electric motor.

Modified primary crusher

Two modifications of the primary crusher were necessary to produce the desired riprap. One was to place the stationary crushing jaw on an angle similar to that of the moving jaw to form a V-shaped trough between them. This was found to reduce the amount of fine material ordinarily produced when the stationary jaw is vertical. The other modification of the crusher was to burn off about 12 in. of the steel plate forming the front face of the hopper to permit the installation of a job-made heavy steel plate trough into which the quarried rock is dumped.

After considerable experimentation it was found that the desired size riprap could be obtained, with the least amount of fine material, or spalls, by setting the two jaws 10 in. apart at the bottom. Moreover, it was discovered that the amount of spalls produced varied directly as the speed of the crusher; the faster the operation, the greater the amount of spalls.

Special endless pan conveyor

The one-man stone riprap and spalls drop from the crusher onto a 36-in. wide, 76-ft. long endless steel-pan conveyor, operating on a 25 percent grade and powered by a 20-hp. gear-head electric motor mounted at the top of the conveyor. The conveyor travels about 75 ft. per min. The metal pans and endless chains are of commercial manufacture, but the steel supporting frame of the conveyor and the driving arrangement were developed on the job in collaboration with the E. F. Marsh Co. of St. Louis.

Crushed rock delivered to the con-

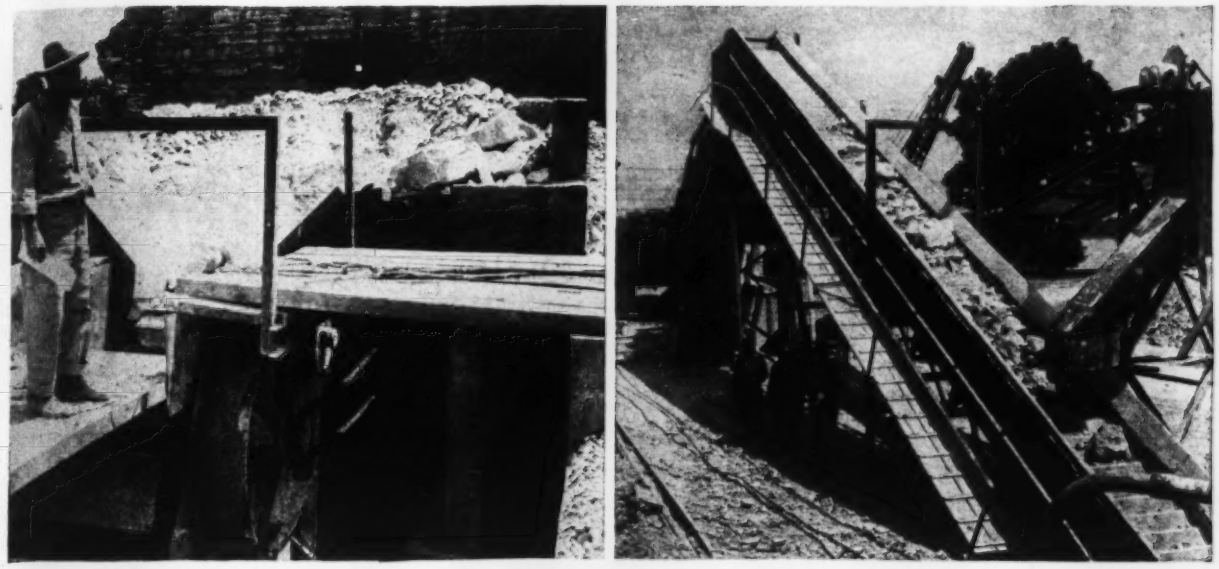


Fig. 2. Quarried limestone is broken into one-man size riprap in a primary crusher (left) and transported by an endless-chain steel-pan conveyor (right) to a job-made screen, from where it is loaded into trucks. Material under 5 in. is further reduced to commercial aggregate and elevated to bins in a storage house.

veyor runs about 50 percent one-man riprap including a permissible amount of spalls retained on a 5-in. screen, and 50 percent passing the 5-in. screen.

Material from the primary crusher is delivered by the conveyor onto a 4-ft. x 12-ft. double-deck vibrating screen driven by a 20-hp. electric motor. The upper screen, which was made on the job, has 5-in. square openings in a $\frac{3}{8}$-in. steel plate reinforced with railroad rails welded on the bottom to give it added weight and rigidity. The lower screen has 2-in. square openings.

Delivered by rail or barge

The one-man stone riprap and spalls retained on the 5-in. screen are chuted into trucks and loaded either into railroad cars on a siding at the plant or trucked a short distance and loaded into barges on the Mississippi River.

All material passing the 5-in. screen is reduced to less than 2-in. size for commercial stone aggregate. That retained on the 2-in. screen is fed into a 42-in. hammer mill, crushed and carried by a second endless conveyor and dumped onto the main conveyor, which returns it to the double-deck vibrating screen.

The crushed stone originally passing the 2-in. screen, and that from the hammer mill drops onto a third endless-chain metal-pan conveyor and is carried into a large storage house on the site, which contains six 100-ton bins.

Crushed stone of any desired size from $1\frac{3}{4}$-in. to $\frac{1}{2}$-in. is deposited in the different bins inside the storage house by an intricate system of vertical conveyors, chutes and screens. A second 42-in. hammer mill, located inside the building, reduces the $\frac{1}{2}$-in. aggregate to any desired size down to and including agricultural limestone.

Production of the plant averages 300 tons of one-man stone riprap and an equal amount of commercial crushed aggregate in an 8-hr. day. The normal work crew is comprised of 20 men, most of whom are engaged in quarrying and hauling the rock.

This plant and two similar ones near Cape Girardeau and Ste. Genevieve, Mo., are operated by Al J. Bussen, president of Bussen Quarries, and his three brothers, Charles, Eugene and Sylvester.

Fig. 3. Drilling in the open quarry is by wagon drills. Shown in the far background is the Mississippi River bridge at Jefferson Barracks, Mo.

Dug Wells Lined With Concrete and Tile Solve Amazon Water Supply Problem

Maj. John A. Logan and J. L. Hummel
Program Engineer and Chief of Sanitation Section, respectively, Amazon Valley Program, Servicio Especial de Saúde Publica, Brazil

***Editor's Note**—A novel design and construction technique has been developed for the installation of dug wells, which are the simplest facility for providing satisfactory water supplies in the Amazon valley. More than a dozen installations of this type are being made in a cooperative public health program operated by the Servicio Especial de Saude Publica, which is sponsored by the Brazilian government and the United States through the Institute of Inter-American Affairs. Features of the well include: Use of a tile made from local materials; a double-wall filter section around the outside; reinforced concrete columns and rings to prevent crushing; a large enough size to provide for inspection and storage; and permanency of construction. In the following article Major Logan and Mr. Hummel provide an excellent background of the water supply problems of the Amazon valley as a preface to understand the advantages of the well construction developed under their direction.*

ONE of the primary needs in the Amazon valley region of Brazil, both from the standpoint of health and utility, are simple installations for public water supply. Not more than four public water supplies exist in the entire valley, including those of the cities of Belém and Manáus, and none of these meets modern standards. The engineering division of the Serviço Especial de Saúde Pública (SESP) has been investigating this problem and on the basis of a two-year field study is now proceeding with the design, and in some cases with the construction, of water systems for many of the communities.

In planning these public water supplies the basic requirements considered, as far as the water itself is concerned, have been: Adequate quantity; satisfactory appearance (clear and colorless); and satisfactory purity (to meet approved bacteriological and chemical standards).

Although it may appear paradoxical with all of the water available in the Amazon valley, the problem of obtaining an adequate source of potable water for public use has proven to be extremely difficult. The obvious source of supply, making use of either the rivers or lakes on which every community is situated, has inherent disadvantages and other sources have had to be considered.

The Amazon basin, covering an area almost equivalent in size to the United States, is essentially a vast network of lakes, rivers and creeks which serve as a highway system for the people. The "canoa" and the "barco" are to the northern Brazilian what the camel is to the Arab and what trucks, cars and trains are to the people of the United States. Life in the Amazon is irrevocably tied in with and influenced by the river, the largest, biggest in volume and by all standards, the mightiest fluvial system in the world.

Valley divided into two regions

For purposes of water supply, two distinct divisions of the valley can be made: From the Atlantic westwards a distance of about 700 miles to Santarém, the river is tidal and the principal fluctuations in its level are tidal and, therefore, of a limited nature. Beyond Santarém the principal fluctuations are seasonal and of a much greater magnitude, reaching to as much as 50 and 60 ft. annual difference between low and high water with changes of as much as 20 ft. in a single day (Rio Branco, in the Territory of Acre).

In the tidal regions the river flows in two directions and pollution is continually washed back and forth in front of the cities. Therefore, there is no safe upstream side from which a supply can be drawn. In the upper reaches the fluctuations in level are considerably greater than the suction limits of pumps and any pump system either has to utilize the wet well principle or a movable setting.

Pollution exists in variable quantities in all surface water supplies and there are few places in the valley where surface water can be utilized without some kind of treatment. As the principal source of pollution is directly from the inhabitants, the rivers adjacent to cities are not safe for use except in the upper reaches of the valley. The main Amazon has a high turbidity and even many of the so-called clear water tributaries, such as the Rio Negro and the Topajoz for example, contain large amounts of color and at times heavy growths of plankton.

To satisfy modern standards it was evident to our sanitary engineers that, although surface supplies could provide unlimited quantities of water, it would be difficult to utilize this water due to the necessity of treatment and in some cases of the construction of elaborate intake structures.

Treatment in itself does not present any serious engineering problems, but treatment plants are relatively complicated, not only to build, but to operate and are subject to breakdowns, shortage of chemicals and lack of proper operation. The use of treatment plants would be further complicated by tremendous transportation problems and supervision of operation.

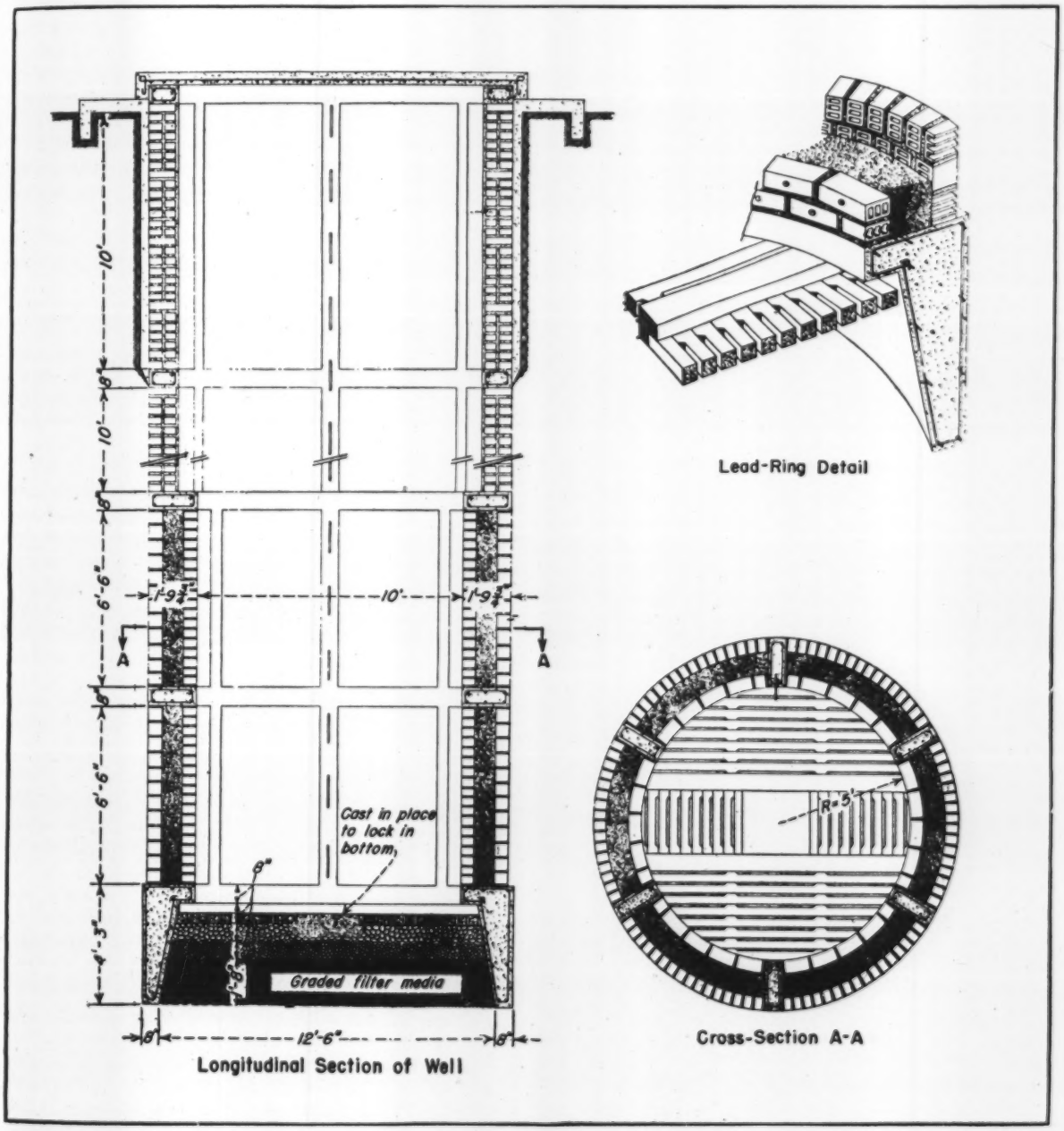
Well water supplies, therefore, were recommended. If a sufficient supply of satisfactory water can be encountered, wells will furnish clear, colorless water

of satisfactory bacteriological and chemical standards without treatment. Their construction involves the use of the simplest equipment and materials, and eliminates the expense and complication of treatment; in other words, a well water supply is ordinarily the simplest type of supply that can be used.

Three principal types of wells are possible; the driven or wellpoint type; the drilled well utilizing a drilling rig with casing and well screen; and, finally, the dug well, ordinarily a shallow well using a casing of brick or wood. Because of the relatively high groundwater level prevailing throughout the valley, water is ordinarily encountered at from a few feet to a maximum of about 100 ft. in depth and shallow rather than deep wells, can be used.

Driven wells have not proven, in general, satisfactory in the Amazon valley due to the difficulty in obtaining screens which will keep out the fine sands normally encountered and because of the limited supply that they will furnish. Drilled wells need special machinery for construction, need imported well casings and screen, and are not necessarily permanent. It was decided, therefore, to utilize shallow dug wells of large diameter.

Dug wells need no skilled labor;



One of the features of the Amazon well is a double-wall filter section around the side as well as a graded filter bed on the bottom. Walls are constructed with perforated hollow tile, the casing being strengthened by the addition of reinforced concrete rings and columns. The relatively large diameter of the bore facilitates inspection and maintenance.

the materials utilized are of a relatively simple nature such as brick, cement and reinforcing steel, and if properly constructed can be made permanent. The large diameter facilitates construction, provides storage facilities and increases the casing to sand contact area, which is particularly important with limited draw-down and fine sands. Fluctuations in groundwater level can be taken care of by utilizing turbine type pumps.

Test well program

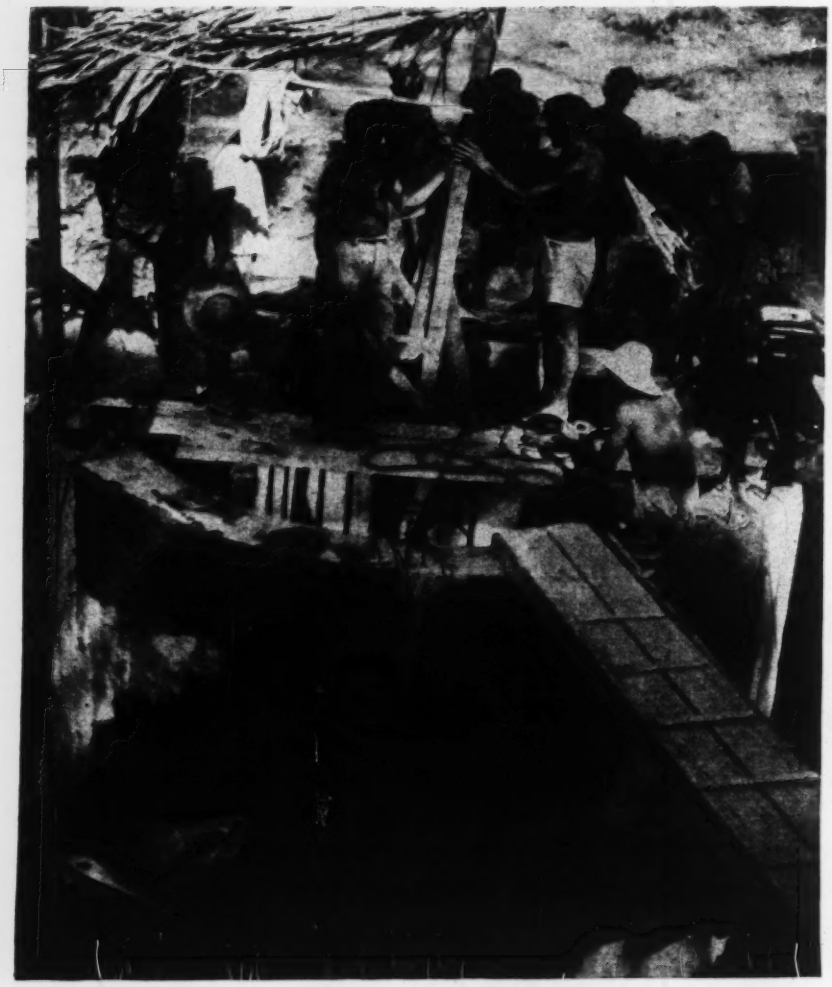
The history of dug wells in the Amazon valley has not been successful in the past due to their lack of reliability; most of those installed have dried up during the dry season of the year. Although the obvious answer is to deepen the well, this has involved serious difficulties. Large areas of the valley are underlain with stratas of fine sand which is "quick" when wet. It has proven impossible to dig wells through this quicksand by any normal means and the fineness of the sand precludes the possibility of developing such layers as an aquifer.

Lack of information regarding the geological strata likely to be encountered has also been a severe handicap; with limited excavation and test hole equipment there has always been the danger of not knowing how far it would be necessary to excavate to reach an aquifer and of having to stop operations before a satisfactory strata was reached. However, successful dug wells can be found in the valley, the simplest of which are open pits, the more elaborate having hollow tile casings lowered into place by excavation.

Before initiating a large-scale water supply program it was decided to inaugurate a test well program in certain towns contemplating public water supplies. These wells were to be constructed as experimental projects and checked to indicate, not only the feasibility of groundwater supplies, but also the estimated cost of an approved type of dug well. Test wells were planned for Abaetetuba, Cametá and Santarém in the State of Pará, and Parintins and Itacoatiara in the State of Amazonas.

In Abaetetuba a satisfactory water supply was encountered at a depth of about 25 ft.; quicksand was not encountered and there were no particular construction difficulties. In each of the other four localities quicksand introduced serious problems. It was found impossible to excavate a well in dry by pumping and excavating at the same time. The quicksand entered in such quantities as to equal or exceed the quantity excavated which besides stopping progress, resulted in serious cave-ins in the immediate vicinity which soon became evident on the ground surface.

The well casing was in every case lowered by undercutting and consisted, as in normal practice, of a single row hollow tile wall plastered on the inside. The cave-ins jammed the casing to such an extent in some cases as to crush it and in other cases to bind it so that it was immovable; in other cases horizontal cleavage planes developed in the walls, the lower portion of the casing breaking away from the upper or bound section. Calculations indicated that difficulties might also be encountered with this type of casing in that the incoming water would all have to enter through the bottom of the well, thus limiting the quantities available.



To prevent seepage of surface water into the well a cement seal coating, about 2 in. thick, is plastered on the outside to a depth of 10 ft.

Construction influenced design

Based on these results, the design and construction of the Abaetetuba water supply system was continued but it was decided to stop work on all the other tests except that in Cametá and in this latter city to attempt to develop a type of construction to meet these special difficulties.

To utilize the sidewalls of the well for the entrance of water it was decided to use a small perforated hollow tile readily adapted to normal manufacture. To avoid the difficulty in pulling sand from aquifers containing quicksand, a double wall filter section was designed to be filled with graded filter media. To prevent the horizontal cleavages and crushing previously encountered.

the casing was strengthened by reinforced concrete columns tied into the reinforced concrete lead rings and other reinforced concrete rings spaced at regular intervals and designed, therefore, against both lateral and vertical stresses.

To prevent "blow-ins" of quicksand into the well during the construction it was decided to eliminate the differential in head from outside the casing into the well caused by pumping the well and to carry on all quicksand excavations under water.

As mechanical excavating equipment was not available, under-water excavation was to be done by use of "duck-out" diving helmets utilizing compressed air. Additional pressure could be provided by raising the level of the water in the well by pumping in water from any convenient source. To prevent sand blow-ins which might occur during operation of the well it later developed that it would be advisable to construct a filter section in the bottom of the well held in place by means of a special reinforced concrete grating.

The filter section of the well was designed to furnish 150 gpm. (based on 25 gal. per capita per day consumption) with the static water level 3.28 ft. (one meter) above the top of the filter, and to accommodate two 75-gpm. pumps.

Diving helmets and air pumps were manufactured in the shops of SESP engineering division in Belém and it was soon discovered that the average "caboclo" took to diving with enthusiasm and was able to work for extended periods in water up to 30 ft. in depth at a satisfactory rate of efficiency. Wall-jetting was utilized to a minor extent, but the bulk of the sinking of the casing was obtained by hand excavation utilizing short handle spades and lead-weighted wooden boxes.

Good results achieved

After solving numerous minor construction and design details, the Cametá well was completed, the test and permanent wells being one and the same. On test pumping it was found to deliver 158 gpm. (the capacity of the largest test pump available) with a small draw-down and without pulling sand. Chemical and bacteriological examinations made in the Evandro Chagas Laboratory (SESP) in Belém have shown that the water is of excellent quality and satisfactory in every way.

Diving outfits for underwater work (right) were made on the job. The helmets are of the "duck-out" type, and with them the natives were able to work in depths up to 30 ft. for extended periods of time.

A similar well, slightly smaller in diameter, was later completed in Santarém and is now being utilized by the fifty-bed SESP hospital recently built in that city.

The engineering division is now proceeding with its public water supply installations in a dozen or more communities in the Amazon valley utilizing this type of design. It is felt that this development offers a distinct advantage over any other type of well heretofore tried, utilizing as it does local materials and local labor, and providing as it does a permanent installation of a size large enough for inspection and storage.

The standard municipal installation includes one or more dug wells with a minimum of two turbine-type pumps. Distribution is provided by means of a network of cast-iron mains with galvanized iron feeders. The principal outlets at the present time are public taps located at strategic points throughout the city, although there is an increasing demand for individual house connections.

There is practically no fire demand as fires are a rare occurrence in the valley. An elevated storage tank provides constant pressure and evens the pumping schedule. Most of the elevated tanks are designed using reinforced brick columns with a reinforced concrete water storage compartment.

Direction of work

Engineering work in the Amazon valley was under the supervision of the senior author who served as program engineer and senior representative of the Institute of Inter-American Affairs. Dr. Eugene P. Campbell is chief, and Lt. Col. George H. Eagle is chief engineer of the Brazilian field party of the Institute, with headquarters in Rio de Janeiro.

Health and sanitation activities of the Institute of Inter-American Affairs in Washington are under the direction of Col. Harold B. Gotaas, president, Col. John D. Yeagley, director and Clarence Sterling, chief engineer.

Welding Repairs on 4,000-ft. Viaduct

John M. Heffelfinger
City Bridge Engineer, Cleveland, Ohio

AMONG the many old bridges throughout the country that have been restored for added years of safe, economical service, the Clark Ave., viaduct, which stretches for four-fifths of a mile across the Cuyahoga Valley at Cleveland, Ohio, is one of the longest. Work completed recently by Vogt & Conant, Cleveland contractors, involved the replacement and reinforcing of trusses, railing and brackets for sidewalk support, the rebuilding of expansion joints, and the strengthening of weakened towers, girders and stringers at a number of points. A new welded wrought iron railing was fabricated by the Park Iron and Welding Co., Cleveland.

Built during the era when riveting was the principal means of construc-

Fig. 1. Removing a section of a corroded gusset on a sidewalk bracket by flame-cutting, while welders wait to install a new plate and to complete the addition of new angles of the bracket arms. Clamps held the angles in place until small tieplates inserted between the up- and downstanding legs of the old and new angles could be plug welded. Then a fillet weld was applied along both sides of the joint between old and new metal, at the gusset plates. In some cases continuous fillet welds were used without recourse to the plug-welded tieplates.

Lincoln Electric Co. Photos

Fig. 2. Floorbeam and stringer reinforcement was accomplished by adding a new plate slightly wider than the existing flange, to permit easier downhand welding. The only overhead welds required are at the ends of the new plates.

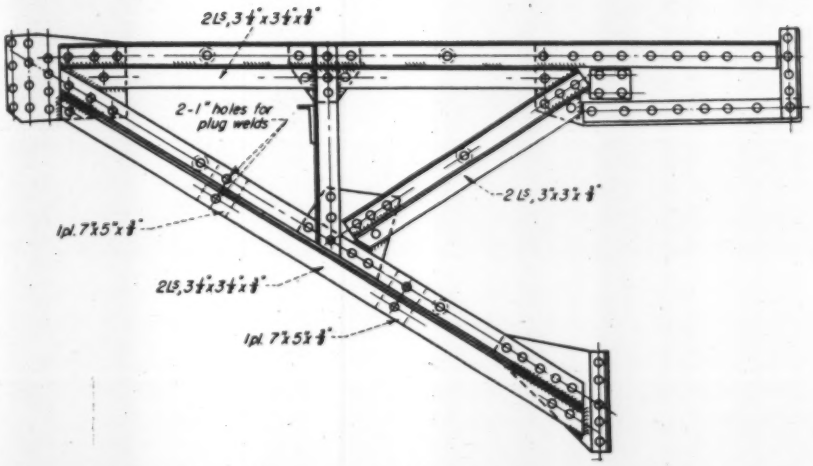


Fig. 3. Detail of welded repair to one of the sidewalk brackets. Note that a continuous fillet weld is used on the horizontal angle, while plug-welded tieplates are used on the inclined knee bracket.

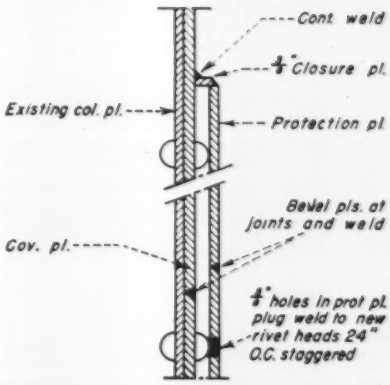

Cont. weld
½" Closure pl.
Existing col. pl.
Protection pl.
Bevel pls. at joints and weld
Cov. pl.
¾" holes in prot pl. plug weld to new rivet heads 24" O.C. staggered

Fig. 5. On some of the columns it was advisable to use two plates, one to reinforce the member, the other as a protective covering to prevent corrosion of the main member under the action of locomotive gases.

tion, the viaduct is of four-lane width for automobile and pedestrian traffic, and formerly accommodated a street railway trolley line, now removed.

Old, corroded sections of members were removed by flame-cutting, and new pieces were welded direct to safe portions of the existing structure. Where necessary, some reinforcements were effected by simply welding in short, single lengths of plate over the worn section. Wherever feasible, new plates were added to both sides of a member thus greatly increasing its strength. Finger-type expansion joints, used both in the roadway and the sidewalks, were either salvaged by building up the corroded sections by welding or replaced by entirely new welded expansion joints, which could be sealed and made watertight.

Thicknesses of new material used ranged from ¼ to ¾ in., with ¼-in. electrode employed to join the thicker plate sections. The welding rod was of a type conforming to American Welding Society specifications, E-6010. Welding current was obtained from a number of gasoline engine driven welders ranging up to 400-amp. capacity. Other details of the repairs are described in the captions to the illustrations.

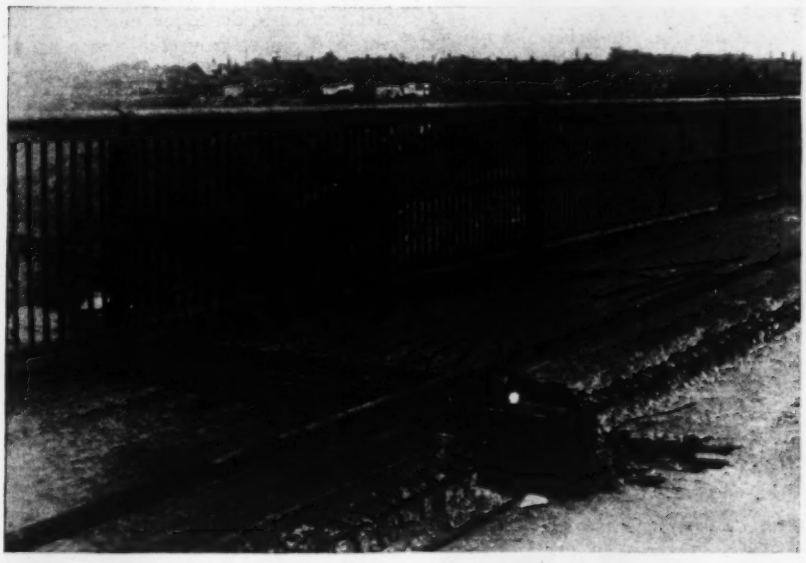


Fig. 4. A new welded wrought iron railing was installed in place of a badly corroded steel one. Structural angles, pipe and bar stock were combined into a design in which special efforts were made to eliminate any places where moisture might collect. Note, in this connection, how the tops of the posts are rounded. Some 7,500 ft. of railing was installed in prefabricated 16-ft. sections, connected at the field joint lugs by bolts.

Porous Concrete Avoided By Simple Method

To prevent accumulation of a layer of relatively porous material of high water content in the top surface of vertical lifts of concrete in structures such as dams and retaining walls, a modification of the usual method of placing concrete has been suggested by F. R. McMillan of the Portland Cement Association.

Instead of the concrete being struck off when the top of the form is reached, it should be allowed to pile up about 2 in. above the form and should be left undisturbed for an hour or so in order that the excess water resulting from bleeding may accumulate in this layer.

Then, as soon as bleeding has ceased, the excess may be struck off and the surface finished in the normal way. The usual porous layer, instead of remaining in the concrete as a potential source of weakness will, of course, be wasted, but the cost of this concrete is small compared to the benefits achieved through elimination of this plane of weakness.

Piles and Pile Foundations

Part III—Making and Interpreting Pile Load Tests

Robert D. Chellis
Structural Engineer, Stone & Webster Engineering Corp.
Boston, Mass.

***Contents in Brief**—Load tests as usually made indicate relationship between the permanent safe load-carrying capacity and the test result only in cohesionless soil. Means of determining the temporary load-carrying capacity of other strata are outlined with suggestions for interpreting and extending the test information. Methods of making pile tests and of loading and unloading the piles with a minimum of work are described. Previous articles in this series covered "Preventing Detrimental Settlement," ENR May 16, vol. p. 774 and "Field Determination of Damaging Stresses in Piles," ENR May 30, vol. p. 863.*

FREQUENTLY the interpretation of pile load test results is baffling to the engineer and incorrect conclusions often have been drawn under the impression that the data were being properly understood. Of first importance, of course, is adequate information. From an inadequate load test or load test curve, great difficulty occurs in finding the true bearing conditions, but from an adequately performed test and curve many essential facts are readily obtainable.

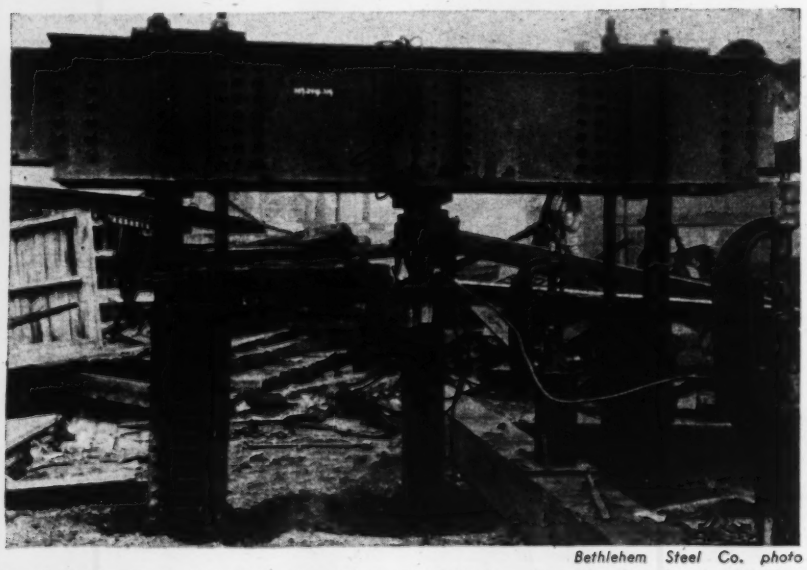
Consider the typical case of a soil composed of a firm top stratum lying over a soft bed of clay, which in turn is underlaid by strata of materials that it is desired to test for load-carrying capacity. One of the functions of piles is to act as columns to transfer load through poor materials to firm support. It should be the purpose of a load to test the material upon which reliance is to be placed for permanent support. Unfortunately, the pile passes through upper strata, which provide temporary support during the relatively short duration of a load test.

Application of the principles of soil mechanics has proved that clay consolidates under load over a long period of time by squeezing the water out of the voids, thus lessening the volume or thickness of the clay stratum; settlement does not occur by flow of the clay to other regions. This is a process that takes years, and one that can not be reproduced in any practicable pile load test.

In the case selected the clay exerts a friction value on the pile limited only by the shearing value of the clay. In addition, the friction value of the upper sand on the pile acts to give it some additional bearing value, since the clay provides good support for the sand temporarily.

Over a period of years, however, unless the clay has been fully preconsolidated by overburden in the past, the clay will not only settle and thus remove temporary support, but will pull down on the pile with additional load. Also, the subsidence of the clay will remove support from the upper sand and its friction on the pile will cause further load to be added.

To determine whether or not the clay has been fully preconsolidated, laboratory tests on undisturbed specimens of soil will be needed. On large projects these should be made, but on very small jobs it may be advisable to assume that the upper materials will settle even under their own weight.



Bethlehem Steel Co. photo

Fig. 1. Hydraulic jack applying load to an 8-in. H-pile. Reaction is taken by friction connection of the loading yoke to adjacent piles.

Data to be obtained from test

A load test should be made in a manner that will permit the location of the center of resistance of the soil for the particular loading to be deduced from the results. The usual load test, as required by many building codes and performed by many engineers, consists of applying in consecutive increments, usually of 5 or 10 tons, sufficient load to equal 1½ or 2 times the working load. In any soil except a cohesionless one of uniform material, it is impossible to predict

from such tests the relationship between permanent safe load-carrying capacity and the test result.

Center of resistance

If the settlements observed at the head of the pile are separated into plastic deformation of the soil, and elastic deformation, the distance from the pile head down to the center of resistance may be computed from the equation

$$l = \frac{\delta A E}{R} \text{ in which}$$

l = distance from pile head to center of resistance in inches.
R = test load, in lb.
A = average cross-sectional area of pile between head and center of resistance, in sq. in.
E = modulus of elasticity of pile material
δ = elastic shortening, in inches.

By removing the load each time before adding the next increment, the rebound or elastic deformation may be measured. The plastic deformation is the difference between the total downward movement and the rebound.

The graph, Fig. 2 (left), shows settlements due to successive load applications and rebounds. By connecting the total settlement points by a smooth curve, the same result is obtained as though the pile had been loaded without removals of load for rebound readings. By plotting the reading at each rebound under the load causing the settlement prior to rebound, a series of points is obtained that, when connected by a smooth curve, gives the graph of plastic deformation. By plotting the differences between these two curves by measuring down from the top horizontal axis, a graph of elastic deformation only is obtained. This gives the actual values of δ for use in solving equation (1) for l, the distance to center of resistance.

Selecting test pile lengths

The length of test pile is selected to penetrate to an assumed resistance stratum, and center of resistance. It is desirable to plot the theoretical elastic line computed by solving equation (1) for δ on the basis of the assumed l, before the test results are obtained. In this way the progress of the center of resistance downward to the desired stratum may be followed and the test continued by adding sufficient load so that, after deducting the amount carried by the upper strata, the lower stratum that it is desired to test will be subjected to as many times

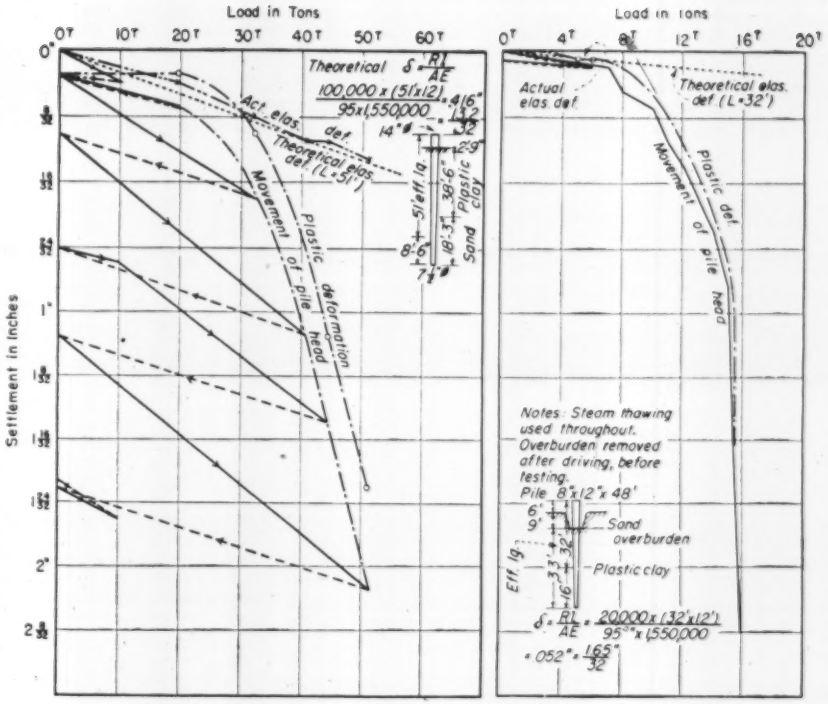


Fig. 2. Load settlement graphs of typical piles. For study at left the pile was unloaded after each successive load increment; that at right was not.

the working load as is the factor of safety desired. Preferably the test should be carried to failure, so that the factor of safety obtained may be known. By "failure" is meant undesirable settlement under load.

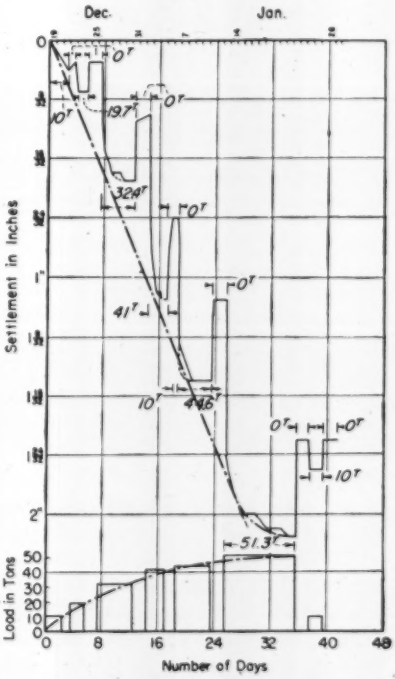


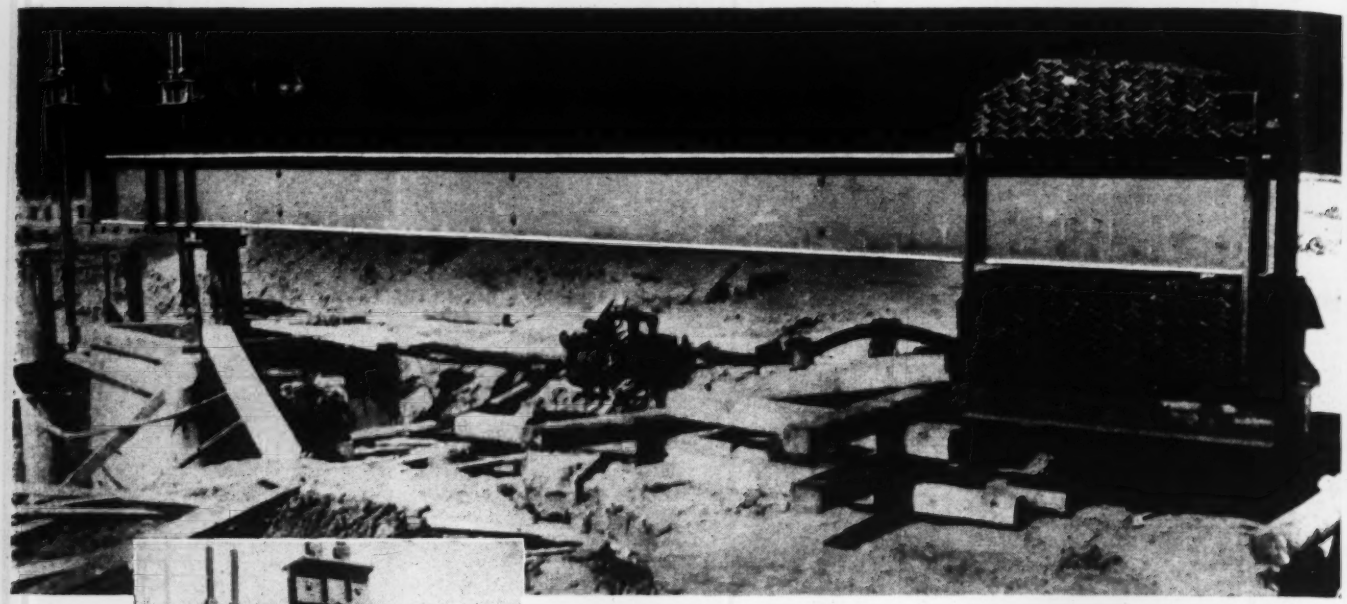
Fig. 3. Load-time and settlement-time graphs for the long pile shown at the left in Fig. 2, driven through sand and into a clay, for successive load tests.

The test pile, having been driven to an arbitrarily selected distance in the firm underlying material, may prove to be longer or shorter than needed to carry the working load with the desired factor of safety. The length may be adjusted on the basis of the friction value per square foot of pile surface determined for the firm material encountered.

Tests at different levels

To determine the friction value exerted by the upper strata, for the example outlined, a pile may be driven to a point just short of the lower stratum, and tested. Another pile may be driven just through the upper sand and tested. The amounts of load, and hence of friction per square foot, exerted on the pile in each of these strata (at the times when settlement is the same as settlements for the first pile) may be deducted from the long pile tests to give the value of the underlying stratum.

A load-settlement graph for a pile driven 33 ft. into a 38-ft. bed of soft clay, for the purpose of testing the short-time supporting power of the clay alone is shown in Fig. 2 (right). The shearing value of the clay may



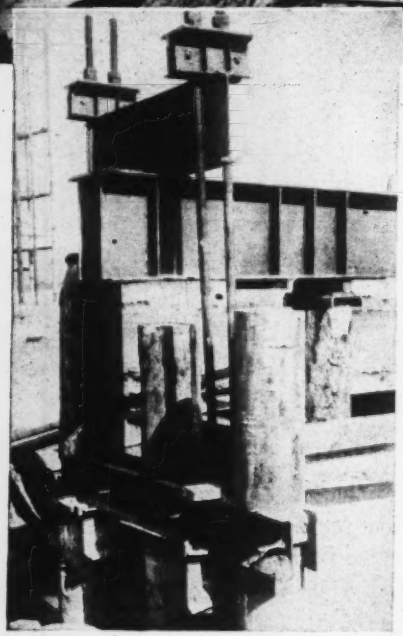


Fig. 4. A load of railroad fish plates on a movable carriage sliding along a pair of cantilever beams gave a load of 80 tons on a test pile. One end of the beams was held down by three uplift piles as shown at left in this Canadian adaptation of a pile test method originated in Australia.

sometimes be gaged by observing the distance the pile sinks under the weight of the hammer. The load-settlement graph for a pile driven through the clay and 18 ft. 3 in. into underlying sand is shown in Fig. 2 (left), while Fig. 3 shows the load-time and settlement-time graphs for the long pile.

Don't rush tests

The pile, after each application of load and each rebound, should be given time to come fully to rest after adding or removing the load. By plotting the rate of settlement to a large scale, the shape of the curve can be seen and the closeness to full settlement or full rebound under that condition judged, since the rate starts rapidly and decreases to small values.

The slope of the rebound lines should be practically the same. Also, the slope should be the same as for the theoretical elastic deformation line so that it may be assumed that rebound has been completed when this condition is reached and, conversely, that it has not been completed unless reached. It is often of assistance to plot this condition on semi-log paper, which shows a sharp bend in the line when settlement is nearly completed.

Many load tests never test more than the capacity of the upper strata to carry $1\frac{1}{2}$ or 2 times the working load temporarily.

In the earlier stages of an adequate load test it will often be noted that the observed elastic deformation line is considerably higher than the theoretical line for the smaller loads, showing that the center of resistance is high and that the load is not reaching the lower stratum which it is desired to test. As the test progresses, the actual line should drop to closely approach the theoretical line, if the center of resistance has been judged correctly.

It will not do to assume, when determining the center of resistance, that all resistance occurs in the lower stratum since for the duration of the test, other forces are in action. Their amounts can be assumed or can be determined by other, shorter test piles. Furthermore, some percentage may be assigned to end-bearing. In Fig. 5 is shown a test where the center of resistance was above the lower firm stratum entirely, due to temporary friction support in a deep clay bed and upper sand crust.

Since movement of the pile relative to the soil is the important factor in determining pile carrying capacity, it would seem preferable to use the graph of plastic deformation rather than the one of pile head movement.

Interpreting test curves

Many rules have been suggested and used for determining the failure point, or safe working load, from test load-settlement curves. One general type of curve shows little deviation from a proportional increase of settlement with load until a sharp drop in settlement occurs, and little difficulty is experienced in selecting the failure point and dividing by a suitable factor of safety. Another general type of curve shows increasing rate of settlement with each increment of load, and forms a sweeping curve starting with very small loads. Selection of the failure point and working load from this type of curve is a much more controversial

subject than with the first type. Sometimes plotting to quite different vertical scales may help to bring out visually a "break" point.

As an aid to judgment and to form a background of past practice, some typical rules for determining safe allowable working load in use are given. No significance should be attached to the order in which they are shown. If all of these rules are applied to a given settlement curve, it is surprising to note the frequent, reasonably close agreement in safe working loads obtained.

There is a considerable difference of opinion, as may be observed from these rules, as to the interpretation of the failure point on load test curves. Unless the engineer has decided opinions upon the matter, it may be helpful to average the rules. For example, applying the rules to the test results shown in Fig. 2 (left) gives a safe working load varying from 11 to 18 tons with an average of 144 tons.

The results of the load test and of the driving resistance computed by the Hiley type driving formula (Part II of this series *ENR* May 30, vol. p. 863) should be in sufficiently reasonable agremeent for piles in cohesionless or essentially cohesionless soils, or for the parts in such soils.

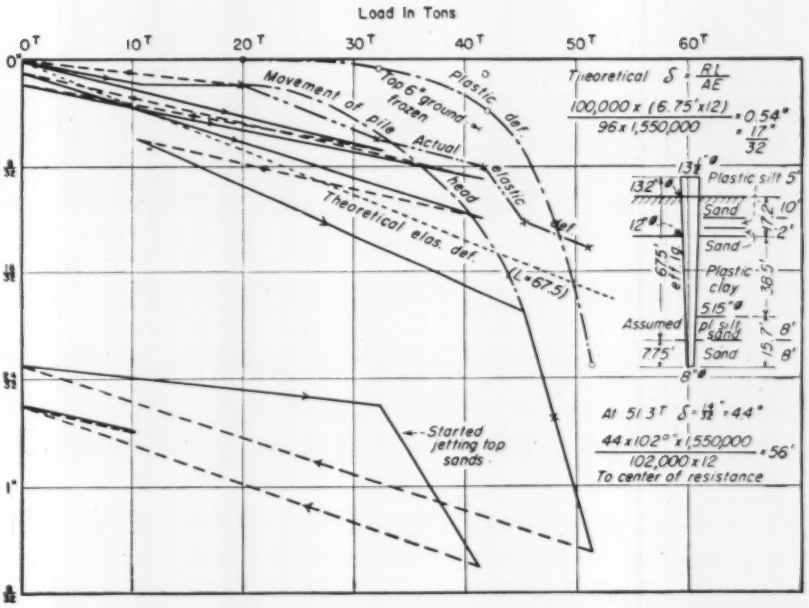


Fig. 5. Center of gravity of friction support of this pile was entirely above the lower firm stratum. Note the effect of jetting the top sand.

Load tests, such as those plotted, may be performed in many ways, according to materials available and magnitude of the test. Those shown were performed in Canada under the author's direction by the apparatus in Fig. 4, suggested by the rig of Fig. 6, developed in Australia.

The Canadian set-up consisted of a pair of cantilever, 24-in. beams ex-

TYPICAL RULES FOR DETERMINING SAFE WORKING LOADS FROM RESULTS OF PILE TEST

1. Observe where the *net* settlement, after application of a load equal to 150 percent of the working load, is not more than 0.01 in. per ton of total test load in 24 hr. (Building Laws, City of New York)

2. Observe the load beyond which there is produced an increase in settlement disproportionate to the increase in load, and apply a factor of safety of two. (Los Angeles Building Code)

3. Observe the load carried without exceeding a total *permanent* settlement of ¼ in. in 48 hr., and divide by a factor of safety of two. (New York State Department of Public Works and Louisiana Department of Highways)

4. Observe the load at which, (no settlement having occurred for 24 hr.) the *total* settlement, including elastic deformation of the pile, is not over 0.01 in. per ton of test load, and divide by a factor of safety of two. (Department of Public Works, State of California; Pacific Coast Uniform Building Code; and Chicago Building Code)

5. Observe at what load the *net* settlement (after rebound due to removal of load) is 0.25 in. and divide by a factor of safety of two. In case of no *net* settlement, consider the working load as ¾ of the test load applied, with interpolation between ¾ and ½ for *net* settlements between zero and 0.25 in. (American Association of State Highway Officials)

6. Observe the load under which the *gross* settlement begins to increase rapidly, and divide by a factor of safety of two. To aid in selecting the point at which settlement begins to increase rapidly, observe where the *gross* settlement begins to exceed 0.03 in. per ton of additional load. (W. H. Rabe, chief designing engineer of bridges, Ohio Department of Highways)

7. Observe the load at which the curve passes into a steep and fairly straight tangent—call this the failure point and apply a factor of safety of one and one half.

8. Draw arbitrary tangent lines to the earlier, flatter portion of the curve and the steeper portion and read the load at their intersection—call this the failure load and apply a factor of safety of one and one half.

9. Observe the point at which the slope of the curve of *total* settlement becomes four times the slope of the curve of *elastic* deformation, and divide by a factor of safety of two.

10. Observe the load that causes a *net* settlement of not over ½ in., remaining constant for 48 hr., and divide by a factor of safety of at least two. (Boston Building Code)

11. Take two thirds of the maximum test load in a case where settlement is not excessive and where load and settlement were proportionate and the curve remained a straight line. Where the test load was carried to failure, take two thirds of the greatest load at which settlement was not excessive and at which loads and settlements were proportionate. (Carnegie-Illinois Steel Corp.

12. With several consistent tests over the area of the structure, take from one half to two thirds of the failure load, considered as somewhere in the vicinity of the "break" in the curve, showing increased settlement per unit of load added. (Bethlehem Steel Co.)

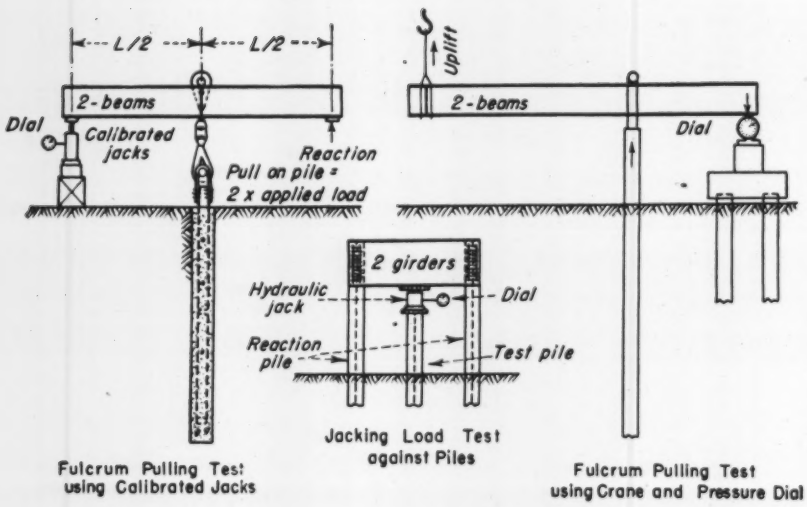


Fig. 6. Hydraulic jacks provide means for pushing piles down or pulling them up.

tending over a roller on the thrust pile with the forward end held down by rods pulling on a pair of cross channels dapped into three uplift piles. A movable carriage with weights of from 1 to 10 tons at various locations gave a load thrust of any value up to 80 tons. The outer ends of the beams were jacked up to obtain rebound measurements.

Use of hydraulic jacks for these tests was not feasible because of the effect of the intense cold of a Canadian winter on oil or water; likewise, inaccessibility of the site precluded bringing in gas cylinders for use with the jacks.

A variation, suggested by a test made by the Bruggen bureau in Holland was previously used by the author for testing piles in water. This utilized a tank at the outer end of the cantilever, which provided variable loads and releases of load by alternately filling the tank by means of a pump on a barge, and draining by opening a bottom valve. Such devices avoid the necessity for heavy loads, large platforms, handling considerable material, and avoid danger of tipping of unstable large loads. They also allow for easily obtaining rebound measurements, and can be made quickly on each job.

An excellent method of obtaining rebound measurements, is to use a hydraulic jack operated by water, oil or gas, provided these are available and the climate suitable. This permits rapid removal and reapplication of loads for rebound measurements. Reactions may be obtained by pulling on previously driven piles. Successful methods appear in Figs. 1 and 6.

Jacking against driving rig

If a heavy pile driving rig is on the job, it may be rigged so that jacking can be done against the hammer and weight of the rig, thus enabling a quick test to be made. This operation is shown in Fig. 9. Loads up to 30 or 40 tons, or even more if the rig is loaded, may be applied in this way.

Use of a hydraulic jack allows the load to be applied in increments and released for rebound measurements.

The lower strata can sometimes be tested directly where it is feasible to provide a casing that will exclude

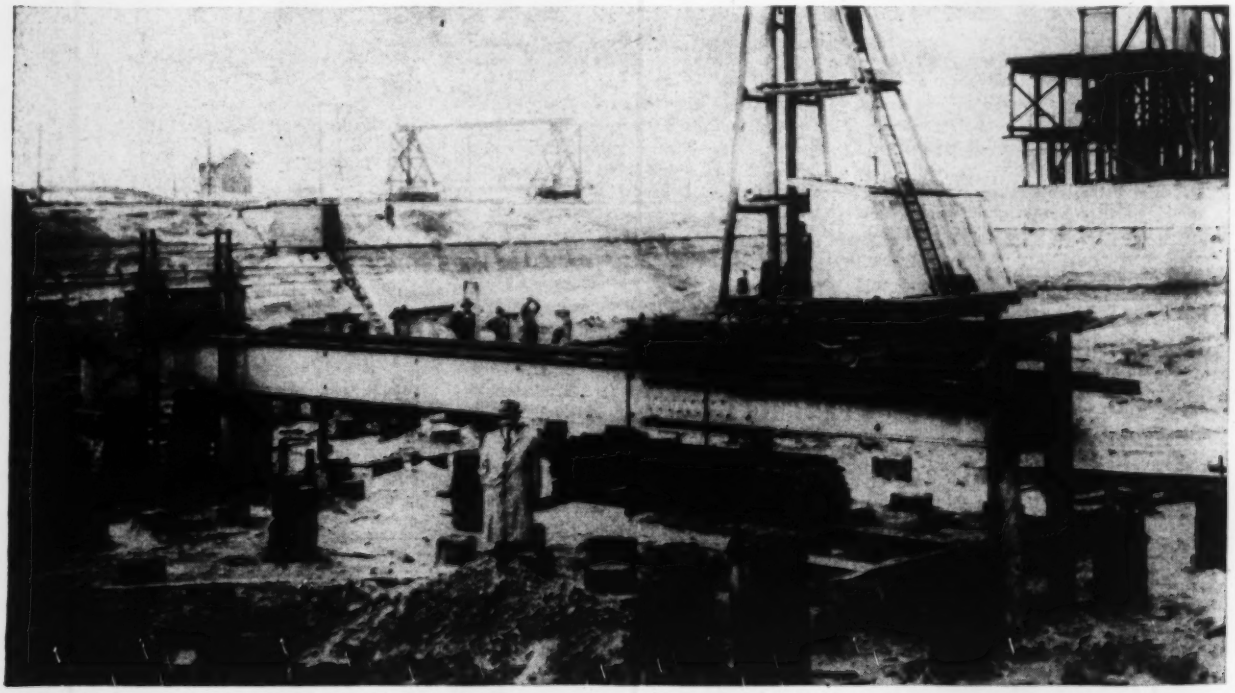


Fig. 7. An Australian test used a rolling car to vary the load on a cantilevered beam. The pile driver frame is entirely separate from the test rig.

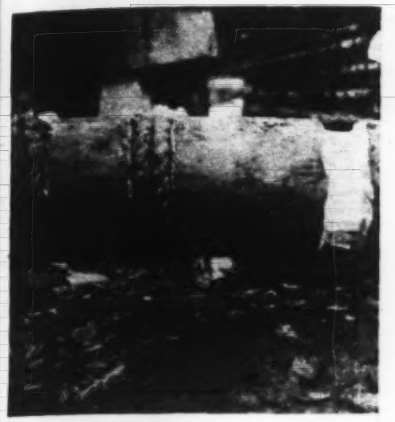


Fig. 8. Rope grommets on pile act as rings to make a piston out of a test pile put down through a casing to test bearing of a lower strata.

friction from upper strata. In some locations an open-end casing can be driven and cleaned out by blowing or excavating. If a rig is used that permits driving a casing and core down to the stratum to be tested, the core can be withdrawn and a rope-grommeted pile driven through it by using the core as a follower. Or the casing and core may be set in the leads above the pile and driven down with it, and then load applied to the core for transmission to the pile.

Returning for a moment to the important subject of determination of the center of resistance of the pile to driving, it is desirable to point out that direct physical measurement can be used with precast concrete, hollow concrete pipes, steel shell or even H-piles. Measurements of downward movement under the test loads may be made at the $\frac{1}{4}$, $\frac{1}{2}$ and $\frac{3}{4}$ points, or at known changes in stratification, for single piles or piles in groups. This can be accomplished with precast piles by casting pipes in the concrete, with hollow piles by inserting closed-end pipes, and with H-piles by welding the pipes to the inner portion of the pile. Bottoms of the pipes are located at the various heights at which the movement is to be measured. Rods can be inserted in these pipes for determination of elevations. The test load should be applied in such a way as to leave the rods visible and free standing.

Another method that has been used for determining the distribution of stress to the soil is by installing Carlson strain meters in concrete and concrete-filled steel shell piles. By recording the actual stress readings at various heights the elastic shortening, and therefore the load, may be computed at any point.

If the stresses or settlements of the pile at the tip and at various intermediate points are known, the elastic shortening of the pile throughout its length may be obtained by subtraction, thus permitting determination of the load supported by the various strata.

It may be said in conclusion that the results of ordinary load tests made without rebound measurements taken to enable the plastic and elastic deformations to be disentangled and the location of the center of resistance determined are very likely to be misleading unless made in uniform materials. Interpretations made by following the usual rules are apt to be widely in error and on the unsafe side.

Reprints of the three articles on Piles and Pile Foundations are available at 25c. for the series; five or more sets at 20c. each.

Address requests to:
The Editorial Department
Engineering News-Record
330 West 42nd St.
New York 18, N. Y.

Fig. 9. Jacking against the pile rig sometimes is an easy way to apply test weight for a quick load test. Note the jack inserted between the pile and hammer.

Underground Garages Advocated

The legislative committee on cities has reported a bill to the General Court (the legislature) of Massachusetts authorizing the city of Boston to permit a private company to construct and operate a garage under historic Boston Common.

It is said that considerable opposition to this measure is likely to rise, mainly on the ground of desecration of an area long held inviolate, but preliminary plans show that such a project would cause no disfigurement of the site since approaches and exits to the garage by tunnels would connect directly with adjacent thoroughfares.

At least two Pennsylvania cities are considering the construction of large subway parking garages. Reading, Pa., with the approval of its city government, is considering the idea of a 2,000 car garage under Penn Square.

At Harrisburg the plan has not yet been approved by the city council, but City Finance Director Warren E. Lyme is advocating that the city construct a 1,000-car garage under Market Square at a cost of about $1,000,000, and lease operating privileges to a private company or operate it as a municipal project. Lyme said there is some opposition in city council to "going into the garage business," but pointed out that "the city is already in the parking business in its operation of parking meters."

A proposal to meet the parking problem at Portland, Ore., by construction of underground garages patterned after the San Francisco facilities met a setback when the Navy vacated the huge public market on the bank of the Willamette River at the foot of Yamhill Street and the city commission began to study the possible use of the building as a parking space for 1,700 cars.

Reports of success of the San Francisco project had prompted a survey by City Traffic Engineer Fred T. Fowler, which showed that downtown traffic moved only eight miles an hour through Portland's narrow streets.

Garrison Dam on the Missouri River To Make Rolled Fill History

***Contents in Brief**—With additional construction funds authorized recently by congressional action and contracts already awarded for preliminary work at Garrison Dam, construction of the dam proper is expected to get under way early next year. Termed the key-dam in the Pick-Sloan plan for development of the Missouri River Basin, Garrison Dam will be the largest rolled fill dam ever attempted. Preliminary contracts include the construction of access railway and highway, a semi-permanent construction bridge and townsite for construction personnel.*

BY THIS TIME next year, according to U. S. Army Engineer plans, dirt will be moving on the biggest rolled-fill dam ever attempted, inaugurating in spectacular fashion the much heralded plan to develop the Missouri River and its tributaries in the interests of flood control, irrigation, navigation and hydroelectric power. To be known as Garrison Dam, the project will be located 75 miles northwest of Bismarck, N. D., on the Missouri River.

Some of the details of Garrison Dam as well as quantities of materials required in its construction assume such proportions that a true appreciation of their magnitude can be gained best by a comparison with similar existing projects.

Four times the size of Denison Dam

Garrison Dam not only will be the largest rolled-fill dam in the world but its estimated 75,000,000 cu. yd. of embankment is more than four times that of Denison Dam on the Red River boundary line between Texas and Oklahoma—the largest rolled-fill dam constructed to date.

When completed, Garrison Dam will have a crest length of over two miles (12,000 ft.) and a base width exceeding one-half mile, exclusive of a 1,250-ft. impervious upstream blanket. It will be 210 ft. high, exceeding the height of Denison Dam by 45 ft. At normal pool elevation of 1850 some 23,000,000 acre-feet of water will be impounded, inundating 390,000 acres of land and creating a reservoir extending 200 river-miles upstream, nearly to the North Dakota-Montana state line.

This reservoir will impound the largest volume of water in the world behind an earth-fill dam. By comparison, Fort Peck Dam in Montana, which is a 250-ft. high hydraulic fill dam, has a maximum reservoir capacity of 19,400,000 acre-ft., a 2-mile crest and inundates 245,000 acres of land.

Size alone, however, will not be Garrison's only claim to fame for its construction will involve a most unusual balancing of cut and fill, the entire 75,000,000 cu. yd. to be placed in the dam being excavated from the spillway and outlet channels. As indicated in Fig. 2, the spillway cut, located in the left or east abutment, will require 29,000,000 cu. yd. of excavation in the 1,800-ft. wide by 3,000-ft. long spillway approach channel, and 27,000,000 cu. yd. in the spillway chute and discharge channel. On the west bank 26,000,000 cu. yd. will be excavated for construction of the outlet works including the cut for the approach channel and tailrace.

Finally, this earth dam's outlet and spillway structures will require 2,000,000 cu. yd. of concrete, a volume that is exceeded only by four other all-concrete dams—Grand Coulee, Shasta, Boulder and Fontana—and this is a distinction of the first order.

Fifteen large conduits

Structures into which this concrete yardage will go include an intake 450 ft. long and 230 ft. high at the upstream toe of the dam joined to eight 24x24-ft. concrete conduits under the dam (in

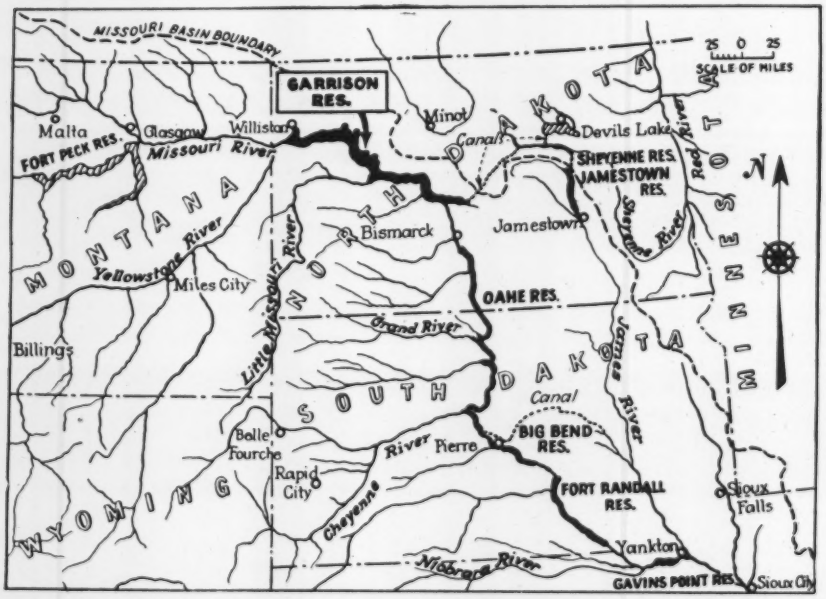


Fig 1. Garrison is northernmost of five projected dams on the Missouri River between Sioux City and Ft. Peck. Many small dams are also planned on the western tributaries in the joint Army Engineer-Bureau of Reclamation program for the Missouri Valley.

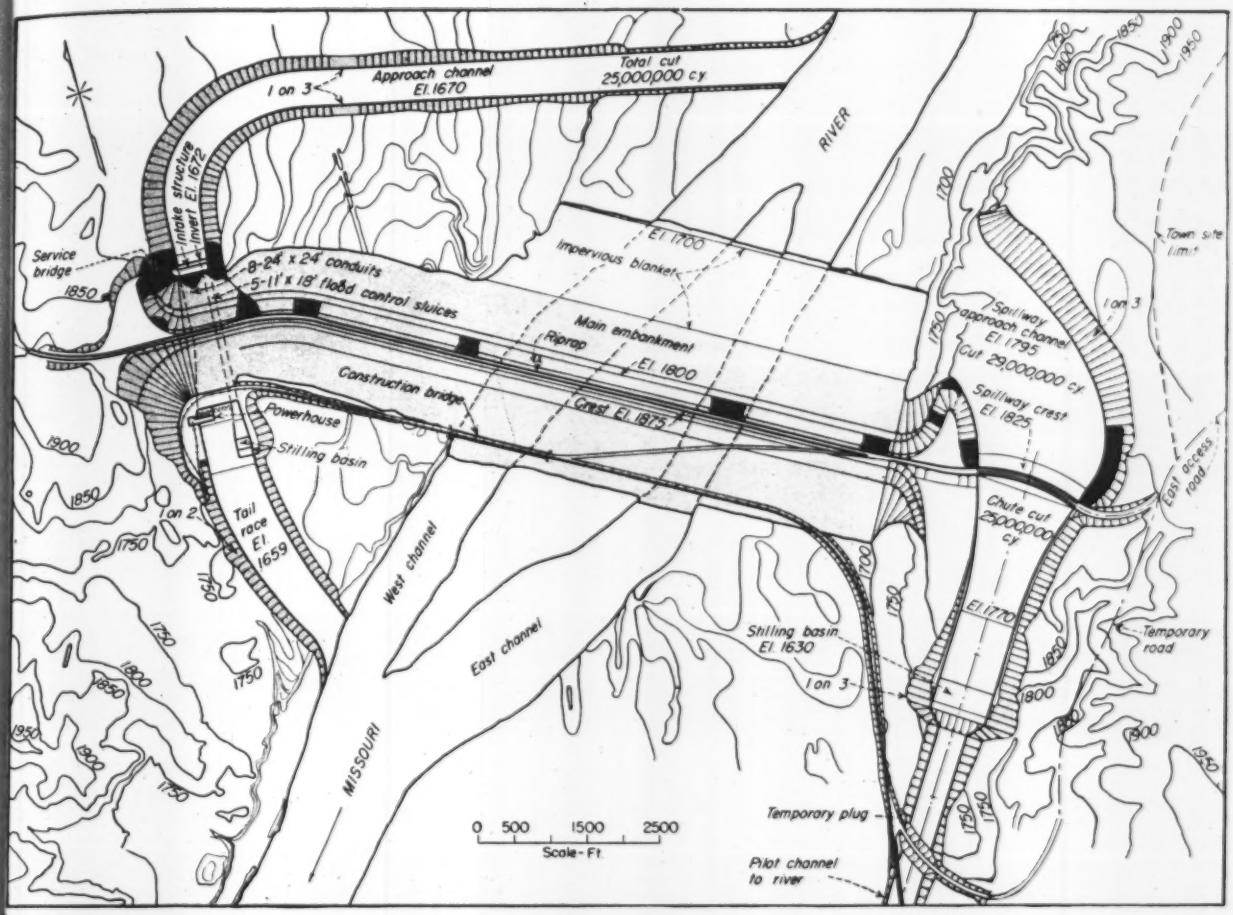


Fig. 2. Largest rolled fill ever attempted, Garrison Dam in North Dakota will be built from 75,000,000 cu. yd. of excavation taken from spillway and outlet channel cuts. Its appurtenant structures will also require 2,000,000 cu. yd. of concrete, a volume exceeded only in Grand Coulee, Shasta, Boulder and Fontana.

which, eventually, 18-ft. dia. steel penstocks will be installed) and seven 10x20-ft. concrete conduits for flood control. All fifteen of the conduits will be required for river diversion during construction.

Facilities for generating electricity at the dam include the initial installation of two 40,000-kw. units in a powerhouse built to accommodate four such units, with provisions for increasing the installation to eight 40,000-kw. units ultimately. At that time the power development will have a potential average gross energy output of 1,520,000,000 kwh. annually.

Two-thirds of the concrete quantities will go into the above structures with the remainder being required for the 1,000-ft. wide chute-type spillway and a 3,000-ft. length of paved spillway channel leading to a stilling basin. The spillway will have a capacity of 750,000 cfs. compared to the record flood in 1881 of 268,000 cfs. The riverbed at the dam is at El. 1665 with the crest of the dam being placed at El. 1875. The concrete spillway lip will be at El. 1825 and will be surmounted by 36 tainter gates each 40 ft. wide and 29 ft. high. Overall length of the spillway will be 1,790 ft. A pilot channel will extend from the lower end of the stilling basin to a junction with the river below the dam.

Preliminary work started

Preliminary work already is underway at the site. The Wm. A. Smith Construction Co., Houston, Tex., is constructing a 10-mile access railway and S. J. Groves & Sons Co., Minneapolis, Minn., are building 13.5 miles of 24-ft. concrete access highway, both approaching the site from the east. A contract also was awarded recently to Missouri Valley Contractors, Inc., Leavenworth, Kans., and Winston Bros. Co., Minneapolis, Minn., for the erection of a 1,350-ft. steel deck girder construction bridge 1,000 ft. below the axis of the dam to transport men and materials across the river to the west abutment.

Bids will be received soon by the U. S. Army Engineers for the erection of a construction town to be known as Riverdale and to be located on the east side of the river about 1½ miles from the site of the dam. Designed for a maximum occupancy of 5,400 construction men and government employees, initial work at the townsite will furnish housing for only 500 to 600 persons. Ultimately the temporary quarters will be removed, leaving a small number of permanent houses for operating personnel at the dam.

It is expected that a contract for excavation and embankment for the dam proper will be let late this year, with other contracts for spillway, outlet

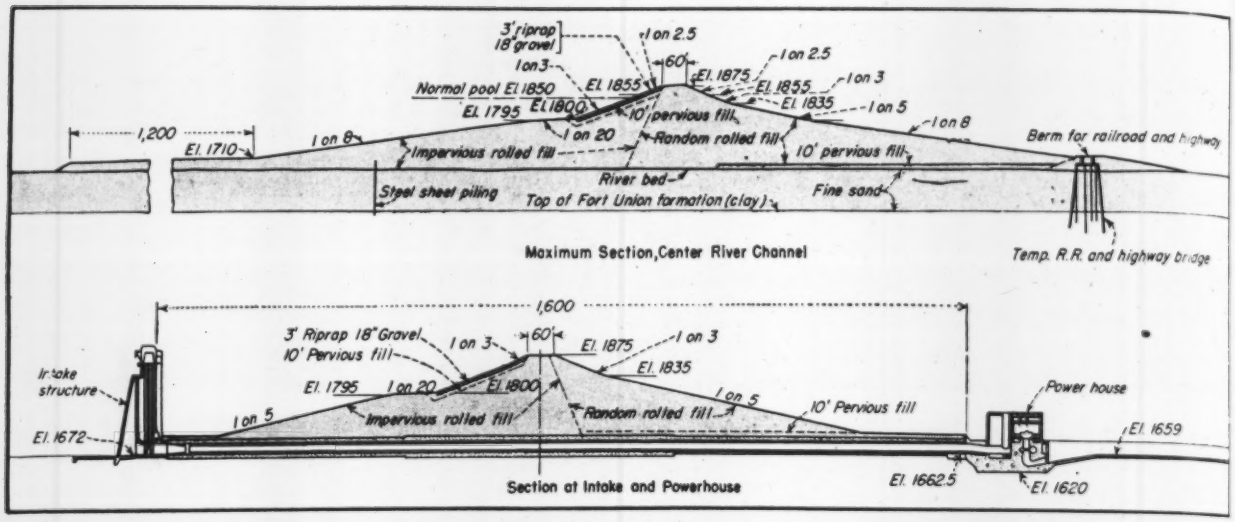


Fig. 3. Section through Garrison Dam emphasize its huge size, 210 ft. high and approximately a half-mile in width at the base.

works and powerhouse to follow. The present construction schedule contemplates 6½ years for completion of the dam and initial power installation.

One of five main dams

Garrison Dam is one of the five projected dams on the main stem of the Missouri River between Sioux City, Iowa, and Fort Peck, Montana, in the joint U. S. Army Engineer-Bureau of Reclamation program for the Missouri Valley, which includes a total of 105 dams and reservoirs to impound 85 million acre-ft. of water. Inclusion of the existing Fort Peck Dam brings the number of such structures to 106 and the total storage to 105,000,000 acre-ft.

Of the new storage of 85,000,000 acre-ft., 58 percent or 49,000,000 acre-ft. will be impounded by the main river dams, with two of the projects, Garrison and Oahe, accounting for nearly 43,000,000 acre-ft. As shown in Fig 1, Garrison reservoir will be located just below the confluence of the Yellowstone River, and thus will serve as a detention basin for the large silt load carried by this stream. Garrison's strategic position will permit water to be diverted by a canal and pumping lift into the James River system to provide domestic supplies, abate stream pollution and aid irrigation in the eastern Dakotas, including replenishment of dwindling Devil's Lake. Principally, however, Garrison's purpose is to effect Missouri River regulation in the interests of flood control and storage of water for multiple purpose use. For detailed information on the entire Missouri River basin program, see *Engineering News-Record*, Dec. 14, 1944, vol. page 757.

The principal material to be excavated for the dam consists of a thick deposit of well consolidated clay and silt known as Fort Union formation. Although it contains some sand seams and occasional streaks of lignite the formation is fairly hard. Tests have shown that it can be placed and compacted to the desired density in the dam with little or no addition of water.

Both abutments are covered with a glacial fill to a depth of about 50 ft. while the valley floor is sand up to 100 ft. deep except along the right bank where there is a deep layer of glacial and alluvial clay. One of the principal problems to be encountered in building the dam will be the difficulty of securing riprap for the upstream facing, none being available closer than southern Minnesota, about 200 miles distant. The gravel in the vicinity is also of dubious quality for concrete.

Designed for settlement

Although the Fort Union formation is a well consolidated clay it is subject to considerable deformation under heavy loads. This presented difficult and unusual design problems since the heavy concrete structures had to be designed for differential settlement of the foundation material.

This factor of differential settlement was particularly acute in designing the huge concrete intake structure which will stand 230 ft. high, and the powerhouse structure with its surge tanks 25 stories high creating variable foundation pressure during operation.

Two-way settlement had to be provided for in the design of the outlet works structure leading from the intake to the powerhouse. This structure, measuring 450 ft. wide and 1,900 ft. long, will contain the eight 24x24-ft. power conduits and the seven 10x20-ft. flood control sluices. Differential deflection of foundation material perpendicular to the long axis of the conduit structure will be provided for by vertical expansion joints extending the full depth and width of the structure.

Joints will be 30 ft. apart and filled with bituminous filler, mastic, and sponge rubber. Width of joints will increase progressively toward the top of the 45-ft. high structure to permit settlement.

Rubber waterstops, installed across the joints, will prevent leakage. Longitudinal construction joints and keyways also will be constructed in the conduit structure to accommodate settlement perpendicular to the short axis of the structure.

Construction plans for Garrison Dam are now being prepared; the data presented herein are based upon preliminary plans. Although Garrison Dam was estimated to cost $130,000,000 in the authorization docket, this was based on 1939 prices so that the present cost probably will be appreciably higher. Brig. Gen. Lewis A. Pick, division engineer, Missouri River Division, U. S. Army Engineers, is in general charge of the work for the army. All design and construction supervision is under Lt. Col. Delbert B. Freeman, district engineer, Omaha District. John W. Sibert, Jr. is area engineer in charge of construction at the dam.

Pioneer Concrete Pavements Survive 35 Years of Hard Service

Keyes C. Gaynor
Consulting Engineer, Sioux City, Iowa

***Contents in Brief**—Thirty-five years ago the city engineer of Sioux City, Iowa, did some pioneering in the use of concrete to pave four miles of streets that badly needed surfacing. Little was known then about concrete paving but it appeared to offer savings over other types, and so it was used. Though the methods employed in laying it were primitive by today's standards, all of the pavement is still in service and some of it shows little sign of wear.*

IN THE YEAR 1911 there was laid on the streets of Sioux City, Iowa, some four miles of concrete pavement. Compared with the large yardage of concrete pavement constructed last year throughout this country, the Sioux City project was not a great event. However, the fact that this Sioux City pavement has been in use for thirty-five years and is still in a condition to render many more years of useful service, despite the crude methods employed in its construction, is something that is worthy of consideration. This is especially true, because the pavement has required very little maintenance during that entire period.

This concrete pavement was laid on streets with various characteristics. Some of the streets were narrow, only 24 ft. wide, while others were 52 ft. wide; some blocks were nearly level while others were on steep grades, as much as 16 percent. Some blocks carried only light residential traffic and some others carried 4,000 vehicles per 12-hr. period.

The pavement has lived and served through the transition period, from horse drawn vehicles to motor vehicles. There were hardly any motor vehicles on the streets of Sioux City in 1911, and there is nothing but motor vehicles in use there now.

A short statement as to just why and how this pavement happened to be laid at that time might not be out of place. Sioux City is largely situated on the bluffs and hills along the Missouri River. These hills are composed of yellow loess which erodes very easily, especially when broken up. The heavy rains washed the dirt from the unpaved streets down onto the paved streets.

As this caused a double expense it was decided to pave these streets, provided a pavement could be found that would not cost over $1.25 per square yard. All of the pavement that had been laid in Sioux City up to that time had cost much more than that. Consequently the city council directed the writer, who was city engineer at that time, to investigate the various pavements that might be used, and try to find some kind of pavement that could be built for the money available.

Few concrete pavements

In that search the writer visited the few cities that then were known to have some concrete pavement. LeMars, Iowa, had a half block near the Union Hotel, and Mason City, Iowa, had several fairly level streets paved with a two-course pavement, the base course a 1–3–5 mix using 1½-in. limestone for the coarse aggregate, and the top course a sand-cement mortar finished smooth with wooden floats.

In Chicago there were some small areas paved with a much advertised two-course concrete pavement called Bloom Granitoid, which was marked off into rectangles to represent granite block, and at Windsor, Ont., there was a three-course pavement using gravel up to 3-in. dia. in the base course and topped with sand-cement mortar.

All these pavements were laid in more than one course, which introduced construction complications, and it was difficult to make the mortar top course adhere to the base course.

One-course pavement

After considerable study of the problem it was decided to build a one-course concrete pavement. The problem was to find a method which would produce enough mortar on top of the concrete so that it could be worked to a smooth surface, which would be

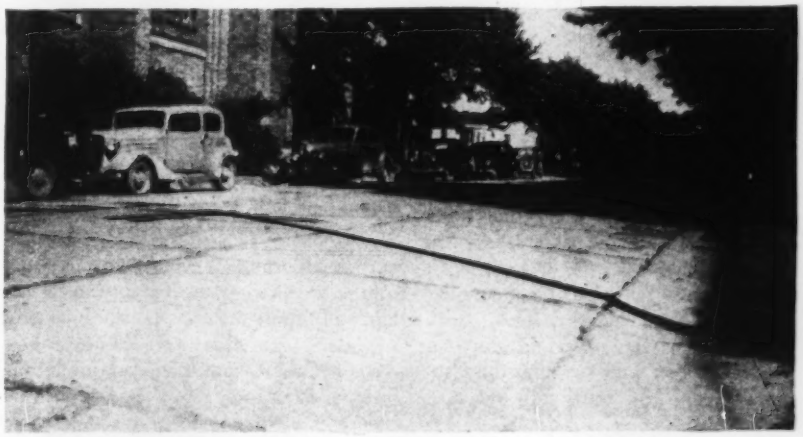


Fig. 1. This unreinforced concrete pavement on 13th Street in Sioux City, Iowa, is still sound after 35 years of service.

Fig. 2. On grades over 7 percent grooves 6 in. apart were tooled into the fresh concrete. Most of the surface on these steep streets has scaled but not deeply.

an integral part of the concrete mass.

It was found that when wet concrete was tamped with a solid faced tamper that the large aggregate would go down with the down movement of the tamper, but would also come up when the tamper was raised. To overcome this difficulty a tamper was equipped with one-half-inch square bars set diagonally with the face and one-half inch apart. It was found that with this tamper the large aggregate would stay down when tamped and that sufficient mortar would accumulate on top so that a smooth surface could be obtained.

The concrete consisted of one part Portland cement, three parts pit run sand and four and one-half parts quartzite, crushed to a maximum size of 1½ in. It was mixed in a large batch mixer placed on skids that was located at the street intersections. The aggregates were measured and loaded into the mixer with wheelbarrows. There was no positive water control at the mixer and the consistency of the mix depended entirely upon the judgment of the mixer operator.

Although the specifications called for a one-minute mix, the time of mixing was not of much concern because the mixed concrete was taken from the mixer in carts drawn by one horse, and there was usually plenty of time between departure of the carts and their return to the mixer for a complete mix to be obtained.

The soil of the subgrade was loess and had been prepared in the usual manner, and had been rolled with an 8-ton roller.

Concrete was dumped in place by the carts and spread to a thickness of 5 in. with shovels. It was then tamped with the open-faced tamper until enough mortar had accumulated on the top of the concrete so that the surface could be finished with the long-handled wooden floats. After several blocks of pavement had been laid it was found that by jiggling the float on the concrete surface the mortar could be accumulated on top as well as with the tamper. This was the forerunner of what today is called vibration.

What is a well known fact today was learned by experience then, namely, that the amount of water in the mix is very important. To get the best results, the water had to be held to an amount that would make the consistency of the mortar something like a soft putty. This was rather difficult with our crude facilities. When there was too much water it had to be drained off as much as possible; excess moisture was taken up by sprinkling the wet spot with a dry mixture of cement and sand.

This mixture would then be incorporated into the surface by the finishers using wood floats. The whole finishing process was of course accomplished by hand power, the finishers working from bridges. Fortunately, expert finishers were employed by the contractors.

Provisions for expansion

Considerable experimenting was done in placing the expansion joints. In the first blocks paved, expansion joints ⅛ in. wide were placed about 30 ft. apart and construction joints about 12 ft. apart. Expansion joints were made by using a wooden board when the concrete was spread and the concrete next to the board was finished with a jointer tool. When the concrete had set the board was removed and the space filled with hot asphalt.

Contraction joints, placed about 12 ft. apart both across and parallel with the street, were made by inserting tarpaper, which was held in place by a wood board. When the concrete was spread, the board was removed as soon as enough concrete had been put in to hold the paper in place. This resulted in the concrete being placed in about 12-ft. squares.

In some places the contraction joints were omitted.

The finished pavement was cured by keeping it sprinkled for several days. There was no reinforcement at all used in any of this pavement.

Because of the prevalence of horse drawn vehicles with iron tires it was thought that this concrete pavement would wear smooth. Consequently, on all streets where the grade was of over 7 percent the concrete was marked across the street with a finishing tool with marks 6 in. apart. These depressions are still there, as can be seen in the accompanying picture.

This pavement has had very little maintenance. About all that has been required has been to clean out the joints and cracks and fill them with asphalt, periodically.

Although there was nothing original about details of construction of this one course concrete pavement, with the exception of the use of the open faced tamper and long handled float, the combination of them was then uncommon, if not original.

These methods were severely criticized by the then Technical Service Bureau of the Universal Portland Cement Co. That bureau, however, was sufficiently interested a year or two later to send an observer to Sheldon, Iowa, when the first concrete pavement was being laid there, using the same specifications as were used in Sioux City.

In going over this pavement today, which is in its thirty-fifth year of service, it is interesting to note how few cracks have developed and that, on much of it, the original float and tool marking are still visible.

The fact that this concrete pavement has already given thirty-five years of service, with many more in prospect, has more than justified the methods used even though some of them were without precedent.

Three-Story Building on Roller Bearings

***Contents in Brief**—To conform to California's laws on earthquake-resistant construction it was necessary to provide for horizontal forces in a three-story addition placed on top of a Los Angeles building not designed for earthquake forces. The solution was to anchor the addition with horizontal ties to an adjacent building designed to resist horizontal forces, while roller bearings transmit only vertical loads to the old building below.*

DESIGN of the recent three-story addition to the Sears, Roebuck building in Los Angeles was required by state law to provide for resistance to horizontal forces set up by earthquakes. Compliance was difficult in this case because the supporting structure, built before that law was passed, was not designed for horizontal loads. The objective was accomplished by a novel arrangement whereby vertical loads go directly to the old structure below, transmitted through roller bearings that prevent transmission of horizontal thrust. Instead, horizontal thrust is transmitted to an adjoining structure by means of horizontal ties in the 10-in. floor slabs.

The present structure consists of several parts—an original building, built to limit heights of nine stories in 1927, and several additions of lesser height (Fig. 1 and 2). One of these additions, built in 1929, is a six-story structure designed to carry the weight of a future extension of three floors that would bring it to the same height as the original building. In 1940 another addition was put on alongside the 1929 portion. This 1940 addition was five stories high and, like the 1929 portion, was designed to receive additional floors that would bring it up to the nine-floor height. A 10-in. separation was left between the 1929 and 1940 additions.

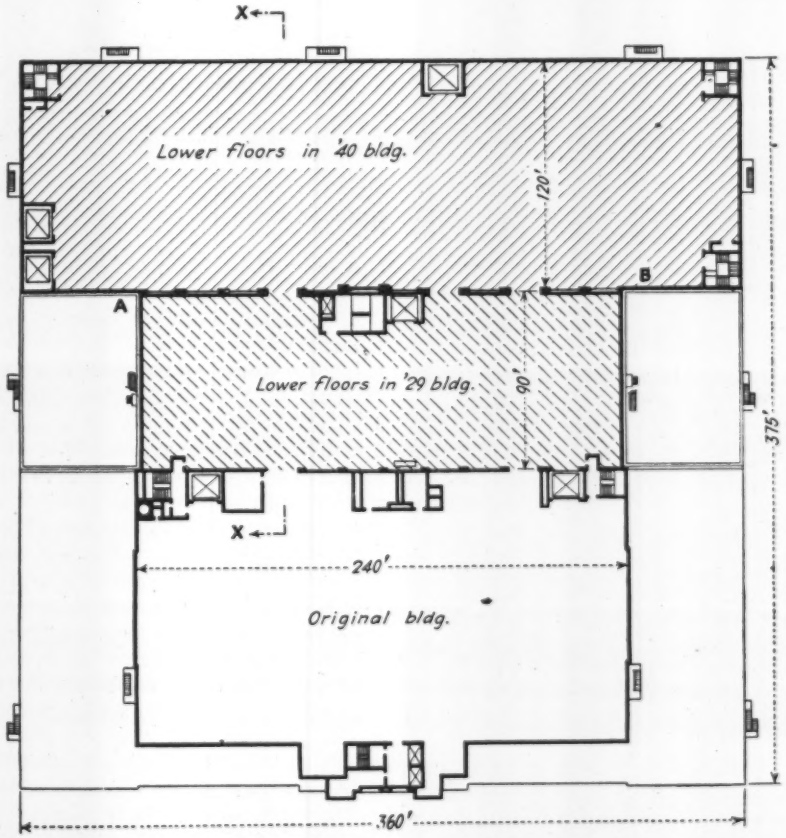


Fig. 1. Old and new portions of the structure shown in plan. The shaded areas are those involved in the 1945 combination.

The problem arising in 1945 in raising the five- and six-story structures to nine-story height was due to the fact that in the intervening period California laws affecting building construction had been materially revised. Prior to 1933, the laws did not require resistance to horizontal forces. After the Long Beach earthquake of March 1933, the building code was changed and made to require that structures be designed to resist horizontal forces such as would result from seismic disturbances.

The 1929 addition, adequate to carry the full vertical load of the proposed three-story addition, was not designed to take the horizontal forces which the law, passed later, required new structures to provide for. In the 1940 addition, on the other hand, which was built in accordance with the new law, adequate provision had been made for horizontal forces. Analysis of the 1929 structure showed that any attempt to strengthen it would involve excessive cost and would result in a highly undesirable disruption of business activity.

A solution in roller bearings

The solution to the problem was found in making separate provision for vertical and horizontal loads. Dead load in the three-story addition would come down, through roller bearings, to the 1929 building which was designed to carry that load and which could legally do so. The horizontal forces would be carried, by means of ties in concrete floor slabs, into the adjoining reinforced concrete building which, in the 1940 addition and in the final extension carried out in 1945, would have adequate strength against horizontal forces. Thus the 1940 addition and the 1945 extension resting

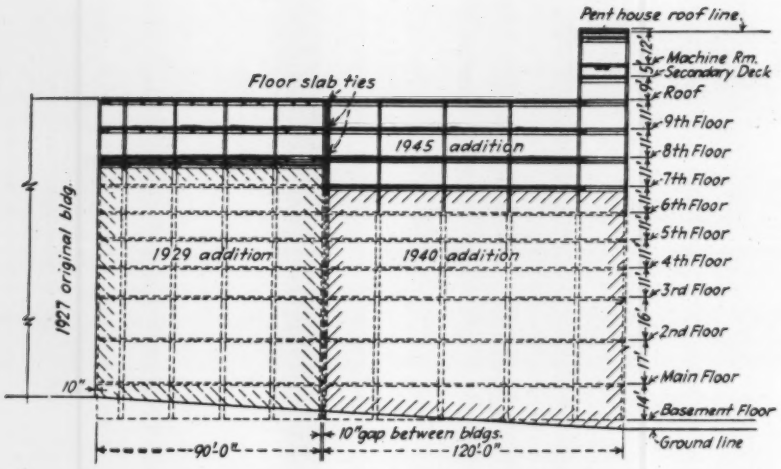


Fig. 2. Elevation on X-X (Fig. 1). The 1945 addition is shown in heavy lines. The part over the 1929 addition is carried on roller bearings, as indicated diagramatically, and is tied at the floor levels to the floors of the part built above the 1940 addition.

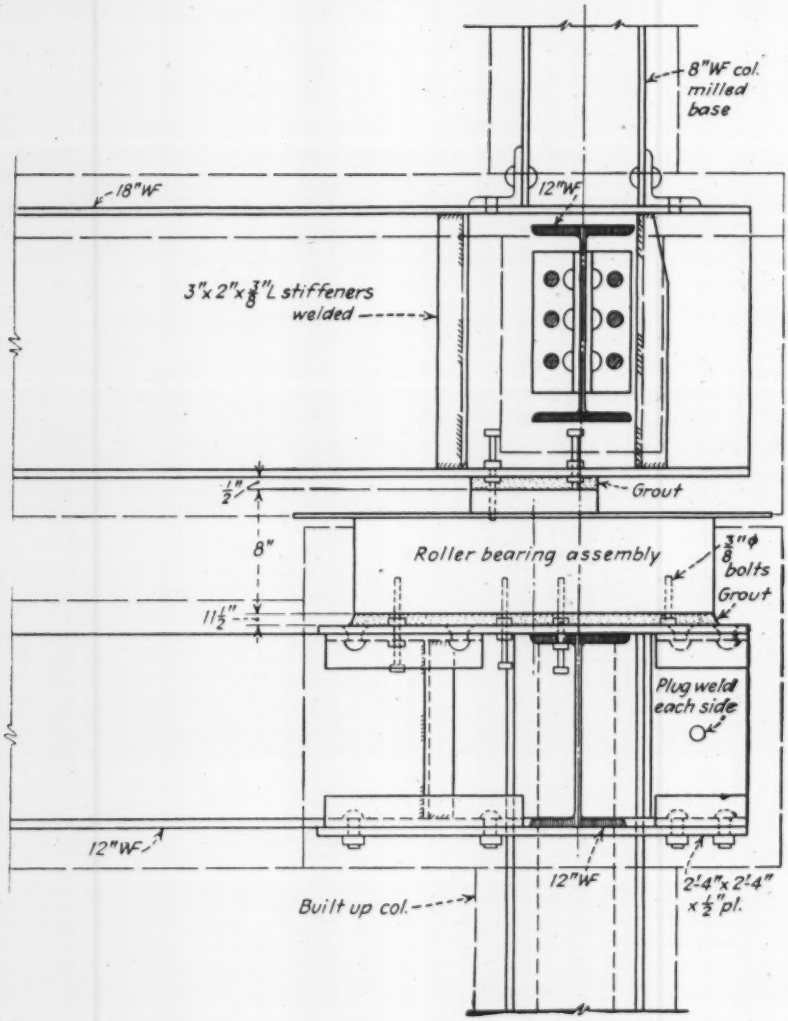


Fig. 3. Details of framing at one of the 65 roller-bearing nests, each designed to support 125 tons. Two systems of floor beam framing were required with the bearings placed between them.

upon it, both of reinforced concrete construction, are to act as a unit in resisting any horizontal forces that may be transmitted from the three-story addition superimposed on top of the 1929 structure (Fig. 2).

At the horizontal plane where these roller bearings are used a double system of steel framing was necessary (Fig. 3). That is, there is complete structural framing in a horizontal plane just below the roller bearings to resist the column eccentricity caused by a relative movement of the column center line, and similarly a horizontal framing system is used to support the loads of the floor just above the plane of the roller bearings.

There are 65 sets of these bearings, one under each of the main columns in the three-story addition. Thus the three-story addition is a complete rigid unit in itself and though its weight is carried by the roller bearings to the building below, there is no rigid connection across the plane of the bearings and the supported structure is free to move horizontally, within certain limits, in any direction.

Two horizontal frames

Because of this necessity for two horizontal framing systems at the bearing level, the distance between the seventh floor ceiling and the eighth floor surface in this portion of the building is about 3½ ft. In this space is the 8-in. height of the roller bearings and the required depth for the two horizontal framing systems.

The design of the bearings themselves started with the intention of using ball bearings. Because each bearing nest was required to carry a load of 125 tons, the concentration was found to be rather heavy for balls with which the Brinelling effect was a disadvantage. When the relative merits of balls and rollers were compared it was found that the rollers increased the friction coefficient only from 0.002 to 0.003. Offsetting this was decreased cost and an increase of the safety factor from 2 to 5½. Calculations for horizontal force were based on a Los Angeles Building Code seismic factor of 0.13 *g* maximum, with which the maximum relative movement of the 1929 building and its three-story 1945 addition were figured to be about 5½ in.

This calculated movement was based on the assumption that the dynamic

period of the two structures would not be the same. If this is true the two buildings might possibly move in opposite directions at the same time. The 5½-in. total movement therefore is the total of separate and opposite movement in the two buildings. These were calculated to be 4 in. for the 1929 building and 1½ in. for the 1940 building.

The bearing design adopted (Fig. 4) consists essentially of three steel plates ground, hardened and polished with great precision and two interposed sets of rollers. The set of rollers between the bottom and the center plate is placed at right angles to the other set which lies between center and top plates. This arrangement permits a 6-in. movement in any direction. That is, the center of the column may move anywhere within a circle 12 in. in diameter.

The bearing assemblies, which weigh about 600 lb. each, are hermetically sealed so that no foreign matter may enter. The rollers are in containers filled with a lubricant which, it is claimed, has been found by test to show no deterioration in a period of 27 yr. To facilitate erection, these bearing assemblies come to the job held by bolted clamps to prevent movement until erection is completed, after which the clamps are removed to permit the bearings to function.

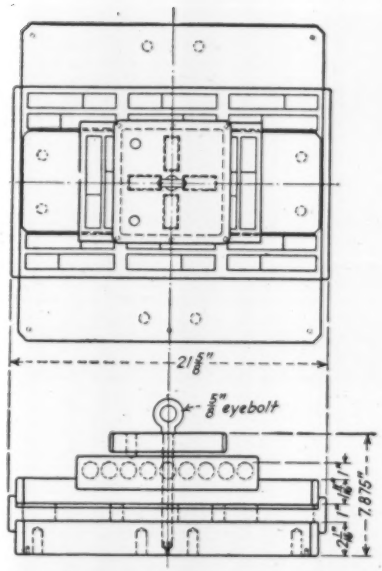


Fig. 4. Two-way roller-bearing assembly that fits between floor systems as shown in Fig. 3. The central eyebolt is removed prior to erection.

To transmit horizontal forces into a structure resting on the ground, ties are provided in the middle of the 10-in. floor slabs of each additional floor above the roller bearings. These ties consist of a double layer of ⅝-in steel bars on 6-in. centers both ways, placed at angles of 45 deg. with the line of the junction and extending 60 diameters into the floor slabs on both sides of that line. This is the line AB in Fig. 1 and its length is 240 ft., the full length of the 1929 addition to the original building.

The roller bearings at the eighth floor level are about 98 ft. above ground level. All of the 1940 addition and that portion of the 1945 addition that is directly above it are reinforced concrete construction. The portion of the 1945 addition that rests on rollers has a structural steel frame used to decrease the weight.

The 1945 addition involving rollers and ties was designed for Sears, Roebuck & Co. by the firm of Bowen, Rowe, Rule & Bowen, consulting engineers and designers, Los Angeles. The bearings were designed and built by the Bantam Bearings Division of The Torrington Co.

London's Underground War Buildings

At the most critical stage of the war in 1940, three underground buildings were built at strategic points in London to house the country's executive and certain government departments. The largest of these, according to an article in the British publication, *The Engineer*, Feb. 1, 1946, was on the site of an old gas holder in Horseferry Road, Westminster, and it became known generally as the Horseferry Road Citadel. Its purpose was to shelter the War Cabinet, the Chiefs of Staff, and their immediate personnel, numbering about 2000 persons, in the event of mass bombing or enemy landings dislocating or destroying the usual channels of communication and offices of administration.

The building was equipped with a power plant, and water and food supplies were such that under the worst war conditions, including poison gas, the building could be lived in for at least three weeks with the maximum number of workers inside. A roof thickness of over 12 ft. of reinforced concrete buried deeply in the earth gave the structure its needed protection.

The power plant was unusually complete since on it depended all of the essential services. Facilities were provided for storage of about 90 tons of fuel or enough to run the plant for nearly a month. Six-cylinder 375 hp. oil engines were used as prime movers, and there were four generating sets accommodated in a room 35x20 ft. and some 50 ft. below the ground. The principal services maintained by the oil engine driven generating sets are lighting (by fluorescent lamps), ventilation, air conditioning, heating, artesian well pumping, sewage disposal and kitchen cooking.

Power requirements

With the building fully occupied the loads were estimated to require about three-quarters of the installed engine capacity, of which the lighting load was not more than 200 kw. Air conditioning and ventilating formed the most important load because under emergency conditions 90,000 to 100,000 cu. ft. of free air was drawn into the building, that is, enough for four changes of air in an hour. Fresh air was taken down a central duct to the bottom of the building and passed through filters and the air conditioning plant before being led to the room services. In case of gas attack, a damper in the air supply shunted the air through a gas filter circuit. The plant was designed to provide 55 to 60 deg. of relative humidity in conjunction with a temperature of 68 deg. F. The full ventilating, air conditioning and pumping load can rise to over 600 kw. The artesian well pump required little power for operation as did the pneumatic automatic sewage ejector.

The building was sunk in some of London's most marshy ground, and seepage troubles formed one of the principal engineering problems. The foundations incorporate a double wall, and water leaking through the outer wall is picked up in the cavity or sump formed between the two walls. It is disposed of by several pumps placed effectively in different parts of the building.

War-Developed Equipment for Peacetime Use

***Editor's Note**—Charged with the responsibility of adapting commercial equipment to military use, the Engineer Board is a research and development agency, many of whose activities relate to civil engineering and construction practice. With the removal of wartime secrecy restrictions it is now possible to report on many developments that have application to peacetime tasks. The following account describes special construction equipment, surveying and mapping instruments and bridging developments.*

EXTENSIVE peacetime use has been predicted for much of the engineer equipment developed during the war by the Engineer Board for the U. S. Army Engineers and demonstrated recently at Fort Belvoir, Va., with the wraps of secrecy removed. (*ENR* April 25, vol. p. 681). Of the captured enemy equipment also on display, several pieces were described as offering advantages over their American counterpart.

Much interest was shown in the crawler tractor that the board had equipped with pneumatic tires (Fig. 1) to permit it to be transported as a trailed load over paved highways at high speed. To prepare the tractor for such a trip the operator by turning a valve raises the front of the machine on built-in hydraulic jacks, and elevates the rear end by lowering the pneumatic-tired wheels mounted on the back below two hydraulic pistons. Next a two-wheel dolly is installed under the frame at the front of the tractor and the unit is ready for transportation as a trailed load.

The particular tractor illustrated is equipped at the front end with a winch. A design has also been worked out to transport tractors equipped with a bulldozer blade. One of the pneumatic tire attachments was manufactured by Fruehauf Trailer Co., and the other by Gunderson Bros. Engineering Corp.

New type trailer demonstrated

To improve the off-road mobility of engineer equipment, the special trailer illustrated in Fig. 2 was built. This unit is powered with two 76-hp. gasoline engines mounted on the rear end of the trailer, power being transmitted to all the wheels by roller-drive chains. In addition, the two engines operate a hydraulic pump which can be used to raise quickly the ramp by merely turning a valve. The trailer, which was built in cooperation with Cook Bros. Equipment Co., is also equipped with a 25,000-lb. capacity winch to permit disabled equipment or that without power to be pulled up the ramp. The trailer has a rated pay load capacity of 20 tons.

A trailer with a structural frame of aluminum was also displayed. This design reduced the weight of the trailer by about 50 percent and the vehicle's performance has compared favorably with that of units built of steel.

A new tool designated the blast-driven earth rod was demonstrated. With this equipment, two men can blast a 12-in. dia. hole 6 ft. deep in clay or gravel soil in 20 minutes. A power earth auger would require 45 min. to dig the same hole.

To operate the rod a charge of about 240 grams of smokeless powder is tamped in place in the large diameter firing chamber at the top of the tool and then detonated to drive the rod into the ground. When the rod is removed, a hole 1½ in. in diameter and about 6 ft. deep exists. The hole is easily enlarged by using multiple strands of blasting cord or by a springing charge of Pentolite (standard army explosive). The cost of making holes in this manner is rather high, but with further development the cost may be reduced sufficiently to make the tool economical.

A weatherproof fuse lighter has also

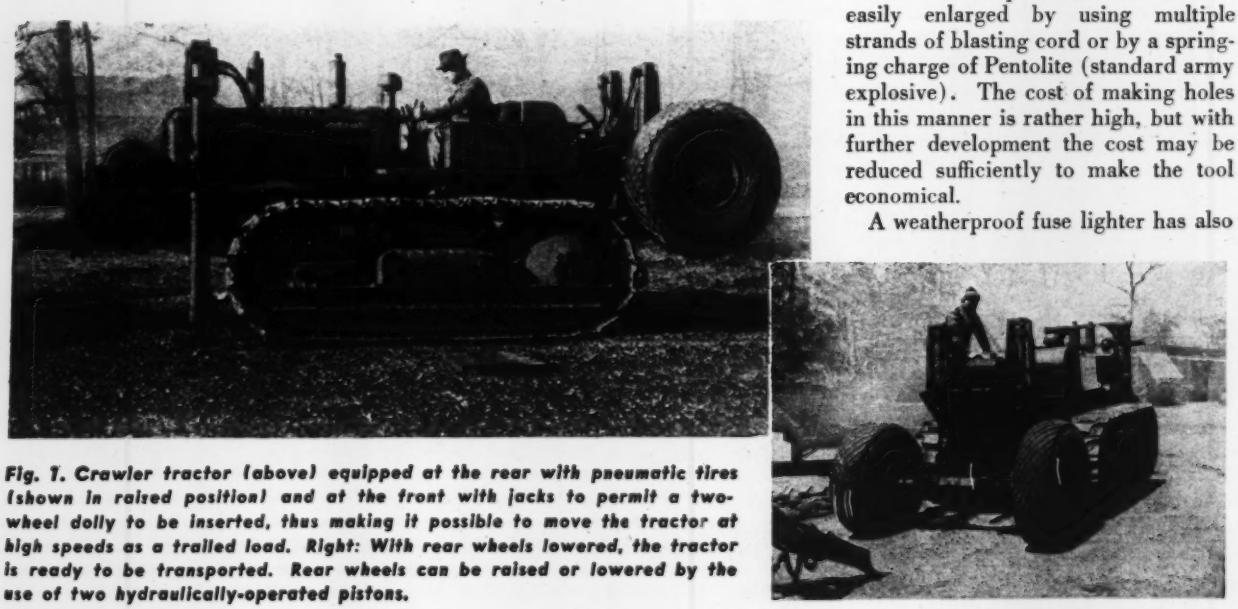


Fig. 1. Crawler tractor (above) equipped at the rear with pneumatic tires (shown in raised position) and at the front with jacks to permit a two-wheel dolly to be inserted, thus making it possible to move the tractor at high speeds as a trailed load. Right: With rear wheels lowered, the tractor is ready to be transported. Rear wheels can be raised or lowered by the use of two hydraulically-operated pistons.

been developed in cooperation with the A. C. Gilbert Co. This lighter is described as easy to apply and operate. its sealing material producing a seal more waterproof than the coating of a standard time fuse. The fuse is ignited simply by pulling out a cotter pin attached to the pull ring at the top of the lighter.

A positive-displacement pump formerly used for handling chemicals and modified for deep well work was exhibited. The pump consists of a chromium plated, stainless steel rotor turning inside a molded rubber stator. Rotor and stator are suspended in the well at the end of a column made up of 2½-in. pipe with an internal 1-in. drive shaft.

Power to drive the rotor is provided by a gasoline engine through a right angle gear head. Normally operated at 1,800 rpm., the pump has a varying capacity from 60 gpm. against a 250-ft. head to 40 gpm. against an 800-ft. head. It can be installed in 4 or 6-in. wells and is capable of handling fine abrasive solids. The complete unit for 500-ft. setting weighs about 5,000 lb. The Peerless Pump division of Ford Machinery Corp. is manufacturing the new unit.

Fig. 2. This special built trailer unit is powered by two 76-hp. gasoline engines mounted on the rear end, power being transmitted to all four wheels by roller-drive chains. The loading ramp is operated hydraulically with power from the two engines. The ramp in raised position ready for attachment to transporting truck is shown in the lower illustration.

Bridge of new design studied

Although displayed only in model form (Fig. 3), the Engineer Board is developing a high-capacity dual-lane variable-span tactical bridge using Baltimore-type subdivided panels rather than the x-braced panel, used with the Bailey truss. Use of aluminum or some other light-weight alloy in constructing the trusses is being considered. Single, double, or triple trusses may be used at either side, the trusses being pinned separately. Model studies indicate that the basic truss must be simplified, erection difficulties reduced, and details worked out for double-story construction and use of supplementary chords. Elimination of the center chord in double-story construction is being considered.

Late in the war two American-built one-second optical reading theodolites were designed and built to specifications set up by the Engineer Board. These light-weight compactly built instruments, which can be set up and oriented quickly, permit rapid direct readings to one second of arc. To make this accuracy possible it was required that graduations be placed on the 4-in. diameter circle to a tolerance of about 1/200,000 of an inch. The circles of one instrument are made of glass. One type of theodolite was built by Keuffel & Esser Co. and the other type by the W. & L. E. Gurley Co.

Surveying level developed

The most recent military level (Fig. 4 left) developed by the Engineer Board is also considered to offer several advantages for peacetime work. It is a three-leveling screw instrument with an internal focusing telescope equipped with a coincidence reading bubble. This design permits more rapid and accurate work. Tests have proven that under normal atmospheric conditions a leveling rod 800 ft. away may be read to within 0.01 ft. This instrument was built by the C. L. Berger and Sons Co. in accordance with specifications of the Engineer Board.

Also displayed was a pendulum astrolabe designed for determining an astronomic position fix for aeronautical charting or small-scale mapping projects where ground control is not available. This instrument, which was built by the David White Co., provides an astro-fix within an estimated probable error of 150 ft. Speed in observation, accuracy of results, and the low cost of the instrument are its outstanding features. Its approximate cost of $600 compares with a price of from $4,000 to $12,000 for similar astrolabes and accessories built in the past.

Studies by the board of the captured German surveying equipment indicates that the Germans were far ad-

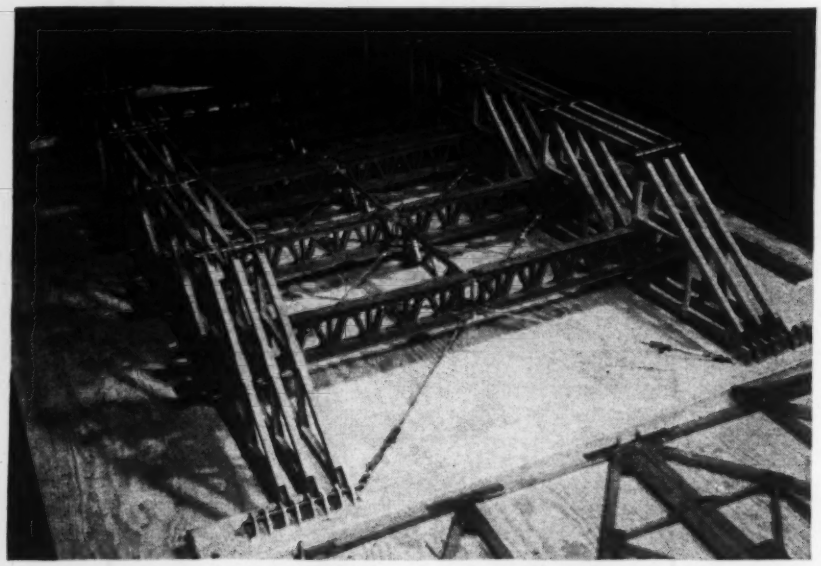
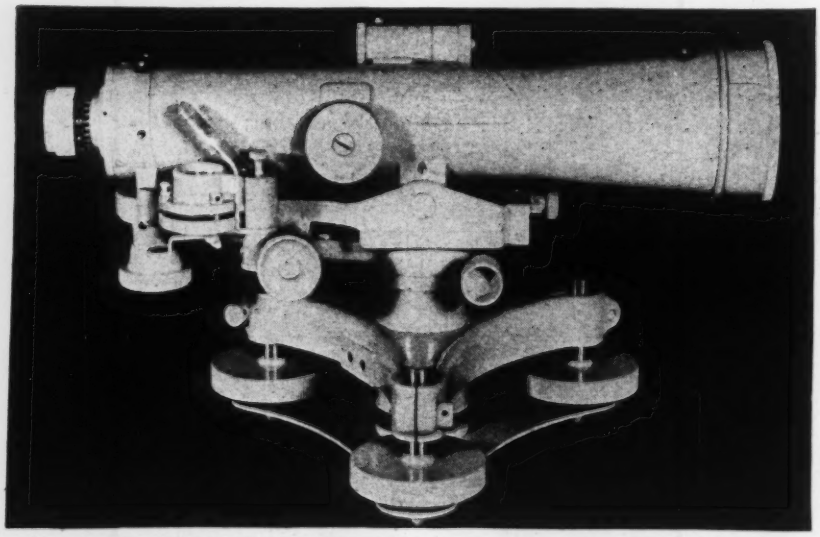


Fig. 3. New type bridge now being studied by Engineer Board features triangular shaped panels and permits use of one, two or three trusses at either side. It is also proposed to develop the design to permit trusses to be used above those shown.

vanced in the design of certain types of instruments. Major advantages were outlined for the German "Dahlta" stadia transit (Fig. 4 right). This transit determines horizontal and vertical distances by the stadia method. The two horizontal stadia wires inside the telescope of the instrument subtend 1 ft. on a vertical rod at a distance of 100 ft. and are so mounted that the distance between the two wires changes as the telescope is tilted up or down from the horizontal. Because of this change it is unnecessary to compute horizontal distances by the complicated formulas commonly employed when using an American-built transit. Instead, the German instrument solves the formula graphically and permits the horizontal distances to be read directly from the intercepts on the rod. Vertical distances are found in much the same manner.

The German stereoplanigraph, one of the most universal and elaborate photomapping instruments ever constructed, was also on display (Fig. 5). This unit is used for plotting topographic maps from stereoscopic photography, and for aero-triangulation from aerial strip photography. The floating point that is viewed in the stereoscopic model by the operator can be moved in three dimensions by means of the two handwheels and the foot pedal. These movements are transferred to a pencil on the drawing board attachment or coordinatograph through a complex train of gears and universal joints. This instrument will accommodate both aerial and terrestrial photography of any tilt, and is equipped with interchangeable projection cameras of 100-mm. and 200-mm. focal lengths.

Those familiar with surveying and mapping instruments also took great interest in a German rectifier on display. This instrument is designed for the rectification of near vertical and low oblique aerial photographs for controlled mosaics and photo maps. It is of vertical projecting type with illumination provided by a single electric lamp and metallic reflector. The camera is fully automatic, in that sharp focus of the projection is maintained at all times by means of mechanical linkages between the motions of the lens, the negative, and the easel planes. It will rectify 6-in. focal length photography with tilts up to approximately 40



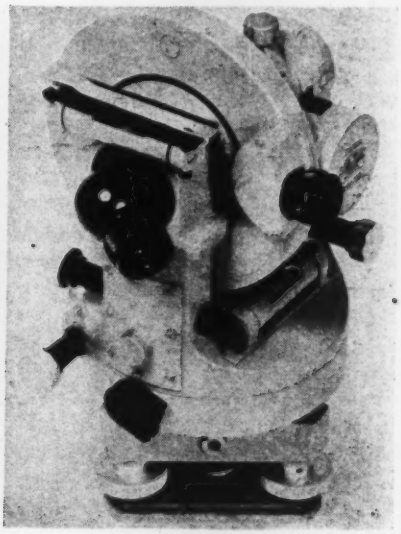


Fig. 4. This latest military type level has only three leveling screws and an internal focusing telescope equipped with coincidence reading bubble. A rod 800 ft. away may be read at 0.01 ft. Right: To avoid the use of complicated formulas in determining horizontal and vertical distances, the two horizontal stadia wires in this German designed stadia transit are mounted in such a manner that the distance between the wires is adjusted as the telescope is tilted.

deg. and has a magnification range of from 0.67 to 4.95 for vertical photography. No American instrument with automatic focus of the type just described is available.

One general outstanding feature of all of the German surveying instruments was the fact that the theodolites, targets and signal lamps fit one standard tripod. As a result of this standardization, more rapid and accurate surveying is considered possible and the investments for equipment for a given project is probably reduced. In addition, several of these instruments were constructed with many of their parts of magnesium alloy, which made the instrument of much lighter weight than its American counterpart.

An electric hammer drill built by the Germans was described as offering wide utility. It is operated by an electric motor, the rotor of which forms a tube or barrel. Inside the barrel and extending down into the body of the drill is a mechanism which transforms the original rotating motion of the electric motor into reciprocating motion, suitable for impact tools, without imposing excess shock on the electric motor.

Dual purpose blow torch

A German combination blow torch and soldering iron described as a practical dual-purpose tool was shown. The burner head is of common design, the fuel tank forms the handle of the torch, and the pump is inside the tank. A sheet metal guard concentrates the heat on the soldering copper, which fastens to the top of the torch and is held in the torch flame. Without the soldering attachment, the device becomes a light-weight, easy-to-handle blow torch with a fuel capacity of about one-half pint. The heat can be controlled effectively by adjusting the control valve.

An unusual compressor

Of the Japanese equipment displayed, a free-piston air compressor of unique design would appear to offer major advantages (Fig. 6). A single combustion chamber, located in the center of the compact, cylindrical housing and fueled through an open nozzle of the Junkers design, drives two opposing pistons simultaneously outward. Each engine piston is extended by means of a separate shaft, to which two compressor pistons are connected rigidly; the first and fourth stage pistons to one shaft, the second and third to the other. When combustion occurs between the two engine pistons, the outward drive compresses air in the compressor cylinders. In this way the conventional crankshaft and connecting rod drives are eliminated.

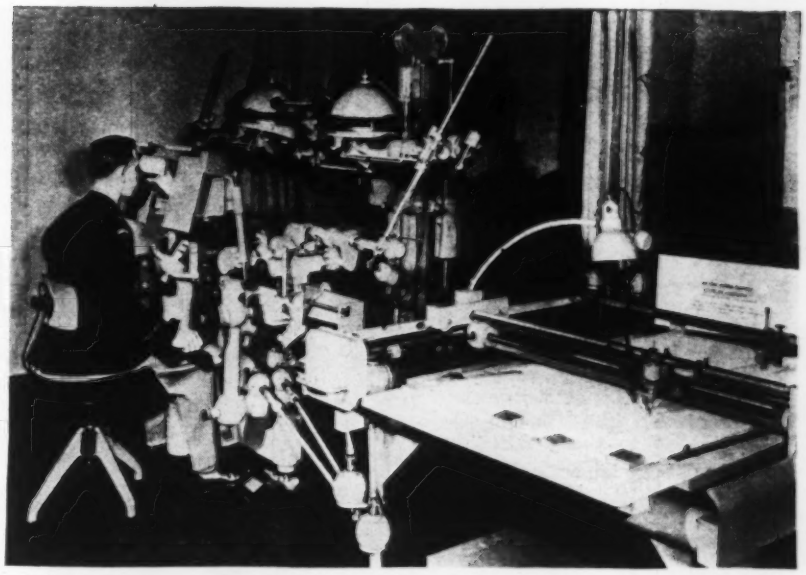


Fig. 5. One of the most elaborate photo-mapping instruments ever built, this German stereoplanigraph will permit topographic maps to be drawn on the board at the right from either aerial or terestrial photographs of any tilt.

All cylinder liners of the compressor are interchangeable. Suction and discharge valves are of the same size, and are of the fully-automatic, spring-loaded plate type. Combination of the engine and the compressor in one unit makes for simplicity in construction and minimizes vibration to such a degree that the unit can be installed without foundation. It simplifies servicing and maintenance and permits a considerable reduction in weight. The compressor delivers 3,000 cfm. at a pressure of 300 psi.

Col. James C. Marshall is president of the Engineer Board and Col. William A. Carter is executive officer. For a detailed story on the organization and functions of the Engineer Board see *ENR* Feb. 8, 1945, vol. p. 199.

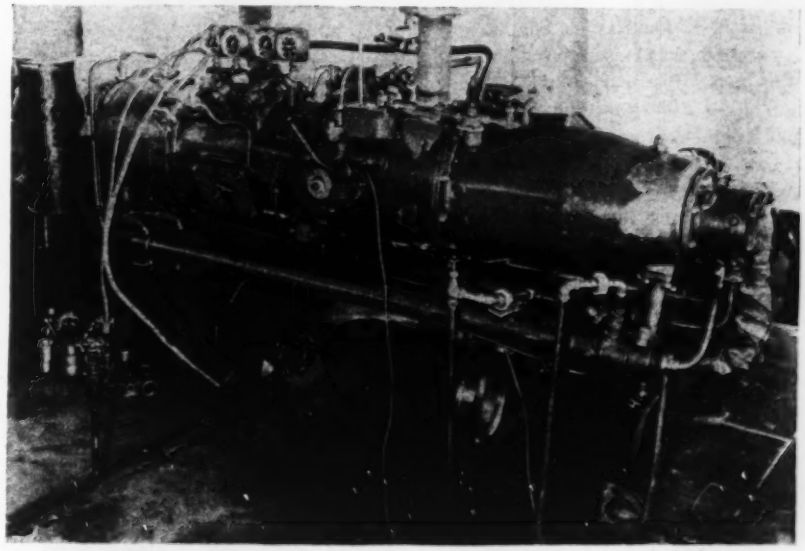


Fig. 6. In this free-piston air compressor, the Japanese eliminated the need for the conventional crankshaft and connecting rod.

Pollution Bill Faces Congressional Test

Compromise legislation offered to Congress would centralize enforcement in federal agencies without making provision for representation of state, municipal or industrial interests.

"The Committee on Rivers and Harbors, to whom was referred the bill (H.R. 6024) relating to the prevention and control of water pollution, and for other purposes, having considered the same, report favorably thereon without amendment and recommend that the bill do pass."

By this statement in its report to the House, the Committee on Rivers and Harbors has undertaken to obtain enactment of H.R. 6024 before Congress adjourns early next month. That bill, which was introduced recently by Joseph J. Mansfield, chairman of the committee, is characterized as a compromise bill that is the outgrowth of the voluminous testimony given at the committee's hearing last fall on the Mundt (H.R. 519), Spence (H.R. 4070) and Smith (H.R. 587) pollution control bills.

But many qualified observers have raised objections to the bill. The most recent was Prof. Abel Wolman of The John Hopkins University, who told an American Water Works Association audience that the Mansfield bill is no compromise measure unless the term "compromise" means the assemblage of the worst features of all the other bills.

Professor Wolman stated, among other things, that the bill provides too much federal representation for control and that many other interests who have a logical concern with stream pollution abatement should be represented.

It is of special interest at this time, therefore, to compare provisions of the compromise bill with those of the Mundt and Spence bills, based on the testimony presented. The Smith bill need not be discussed because no support was accorded to it.

Although the Mansfield, Spence and Mundt bills provide, in general, for similar objectives and purposes, the means of accomplishment are widely different, particularly as regards administrative procedure. Broadly speaking, all the bills are aimed at pollution abatement by means of: preparation of plans for remedial works; encouragement of uniform state pollution laws as well as pollution-prevention compacts between states; and collection and dissemination of information to state agencies, municipalities and industry.

Also provided for in all three bills are loans and grants-in-aid to states, municipalities, other public bodies and industrial enterprises.

Administered by Surgeon General

First important provision in which the three bills differ widely is that concerning administration. The Mansfield bill places this under the Surgeon General of the U. S. Public Health Service, with a "Water Pollution Advisory Board" established in the U. S. P. H. S. and composed of the Surgeon General and representatives of the departments of War, Interior, Commerce and Agriculture. No representation of other than federal departments is included, thus eliminating from the advisory board representatives of such interested parties as states, municipalities and industry.

In the Spence bill, however, while administration would also be centered in the Surgeon General, his actions would be under the direction of the Federal Security Administrator, and the advisory board would include, besides those specified in the Mansfield bill, a sanitary engineer and a representative each of wildlife conservation, municipal government and affected industry. This feature of the Spence bill met with almost universal approval by state sanitary engineers and other witnesses at the hearing as being more nearly equitable to all parties concerned.

On the other hand, administrative procedures outlined in the Mundt bill were bitterly attacked because they called for purely federal control by establishment of a "National Board of Water Pollution Control" composed of the secretaries of Interior, Agriculture, War, Navy, the Surgeon General, the chairman and ranking minority member of the House Rivers and Harbors Committee. In addition there would be an operating commission appointed by the board and consisting of two commissioned officers of the Public Health Service, two officers of the Corps of Engineers, and one representative each of the Fish and Wildlife Service, Bureau of Mines, Bureau of Reclamation, Soil Conservation Service and Forest Service. Here also, no representatives of state, municipal or industrial interests are included.

Another provision of the Mansfield bill—taken directly from the Mundt bill—provides for "classifying" the waters of the country into "sanitary water districts", for fixing standards of cleanliness in each district and for establishing minimum treatment requirements in each. At previous hearing this provision was attacked on the grounds that if it became law existing state sanitary departments already set up to handle those phases of the work would be needlessly duplicated.

Federal vs. state enforcement

Another of the provisions of the Spence bill meeting with wide approval is that which delegates enforcement to the appropriate state health authority or interstate agency when, in the opinion of the Surgeon General, the health and welfare of U. S. citizens is jeopardized by pollution of waters.

The Mundt bill, by contrast, provides for federal court action to prevent or abate pollution at the request of the national board; such action would be authorized after state or interstate agencies have failed to act within six months after being notified to do so by the commission. This latter method of enforcement has been criticized as being inefficient, time-consuming and costly.

In spite of the overwhelming testimony favoring enforcement at the state level, the Mansfield bill provides that enforcement be solely a function of the Surgeon General, who has the duty of bringing court action if interstate, state or local authorities fail to prevent or abate the nuisance within six months after being notified by him.

Regarding the time limit within which industry or municipalities must secure abatement of pollution, the Mansfield bill sets the same two-year period as that established by the Mundt bill. By contrast, the Spence bill recognizes the difficulties of compliance in individual cases by provision for exercise of judgment in the form of "a reasonable time", rather than a definite period.

Because of the arbitrary limit set by the Mansfield and Mundt bills, both necessarily carry a provision for allowing time extensions after the two-year period, a maximum of five years being specified. Here again the question of state versus federal enforcement enters the picture, a large share of the testimony indicating that state authorities generally would have closer control than would a board having nationwide responsibilities.

How the work will be financed

Other major differences in the provisions of the bills include those regarding appropriations for administration and for loans and grants-in-aid.

No funds for administration are specified in the Spence bill. Both the others set definite amounts—$250,000 in the Mundt bill and $1,500,000 in the Mansfield bill. These figures alone are seen by many state sanitary engineers as indicative of the degree to which pollution control will be arbitrarily vested in the Surgeon General's office, to the exclusion of the state sanitary department enforcement they have already expressed themselves as favoring in their support of the Spence bill.

In the matter of loans and grants-in-aid for planning and construction, the compromise Mansfield bill follows the provisions of the Spence bill, which authorizes $100,000,000 for the purpose. No definite sum is set by the Mundt bill, although appropriations are authorized in amounts and under conditions that may be prescribed by Congress. This latter, flexible appropriation policy likewise had been frowned on by many of the witnesses, who fear that this may later prove an easy opening for political control.

Federal legislation for the control of stream pollution has been a hotly debated issue since 1935, the only surcease occurring during the war years. While there seems to be strong interest for a national law on the subject, many qualified observers do not believe that the Mansfield bill will meet the need for strong but sympathetic handling of the problem.

More Cities Establish Parking Lots To Ease Traffic Congestion

Two hundred and eighty American cities are now operating municipal off-street parking lots states a report from the International City Managers' Association. This marks an increase of 35 percent over the number of such parking facilities in use in 1942.

The association predicts a further increase during the next few years in the establishment of off-street parking lots, parking garages, and underground parking areas.

Five hundred and seventy lots with an aggregate capacity of 75,000 vehicles are operated by the 280 cities. A recent survey among cities over 10,000 in population reveals that 30 percent now have municipally-owned lots for off-street parking.

Detroit voters have approved a proposal for an underground parking garage to be financed by revenue bonds, and Dallas has completed a study on financing a 6,000-car lot connected by subway with the business district. The Chicago city council has adopted a resolution requesting the legislature to permit the city to build and operate parking lots. Initial action has been taken in numerous other cities.

Thirty-eight percent of the cities surveyed in the 10,000 to 25,000 population class now own and operate municipal parking facilities. Competition with nearby big cities for retail business is one important reason for the high ratio in smaller cities.

Quincy, Mass., with a population of 75,810 reports an expenditure of $450,000 for acquisition and improvement of parking lots. Kansas City, Kan. (121,459), spent $384,000. Cities spending from $50,000 to $100,000 include Madison, Wis., Port Huron, Mich. and Winnetka, Ill. These figures do not include operating expenses.

Only 15 cities charge motorists for parking. Rates range from 10 cents a day in Akron, O., to 25 cents an hour in Miami Beach, Fla. The lots of all but 10 cities are open 24 hours a day though dead storage is not permitted. Parking time limits ranging from 2 to 24 hours are imposed in 34 cities.

Big cities ban street parking

Two more large cities have prohibited street parking in their downtown business districts, according to the International City Managers' Association, which states that Cincinnati and Philadelphia have taken this action recently.

The Cincinnati ban on daytime curb parking for passenger cars was put into effect after a 2-month trial period showed that it relieved traffic congestion by making it possible for trucks to pull in next to a curb for loading and unloading without double or angle parking on the city's narrow streets.

Free city parking lots

To meet the passenger car parking problem, Cincinnati has provided two large free parking lots at opposite ends of the business district. In addition, the city provides a shuttle bus service from the parking lots to the business district for 5 cents. At night, street parking is permitted provided that no car remains in one spot for more than six hours.

In Philadelphia, following a 90-day trial period the city council adopted a traffic ordinance that prohibits street parking in the central business district from 8:00 a.m. to 6:30 p.m. After a survey indicated that less than three percent of the shoppers who drove to the business districts parked at curbs, city merchants supported the ban on parking. The Philadelphia City Council also appropriated $20,000 for a survey of off-street parking facilities.

Penstocks and Power House Damaged As Result of Falling Boulder

Damage to three of the four penstocks serving the powerhouse of the Southern California Edison Co.'s Big Creek plant No. 1 was caused by a boulder which slid from its place and bounded down the hillside, as reported in *ENR* Apr. 25, 1946, vol. p. 630. In the following is more detailed information about the accident which caused serious damage in a powerhouse where hydraulic turbines operate under a head of 2,130 ft.

Despite the fact that power company personnel frequently patrol the penstock line and have done so for the past 35 years, always on the alert for indications of danger from slides, the boulder that came down the hill on April 6 had never been recognized as a potential menace. The ground slope where the boulder lay was relatively slight, but was sufficient, as developments proved, to permit the boulder to slide on earth saturated and softened by melting snow and rain. Once started, the boulder gained momentum on the steepening grade, which was 41 deg. at the top of the penstock.

The boulder, estimated to weigh about 5 tons, bounced down between penstock lines 1 and 2, striking the No. 2 line heavily in about a dozen places and also doing some damage to line No. 1. At a point some 300 ft. below the original position of the boulder, the 3/8-in. plate of No. 2 line was dented to a depth of 4 to 5 in. At this point the pressure in the line was about 200 psi. which was sufficient, after the boulder damage, to tear open the top of the pipe, as shown in the accompanying sketch, leaving a flap of the 3/8-in. steel plate standing nearly vertical and a break in the pipe 8 ft. 2 in. long and 4½ ft. wide as measured around the curve of the pipe.

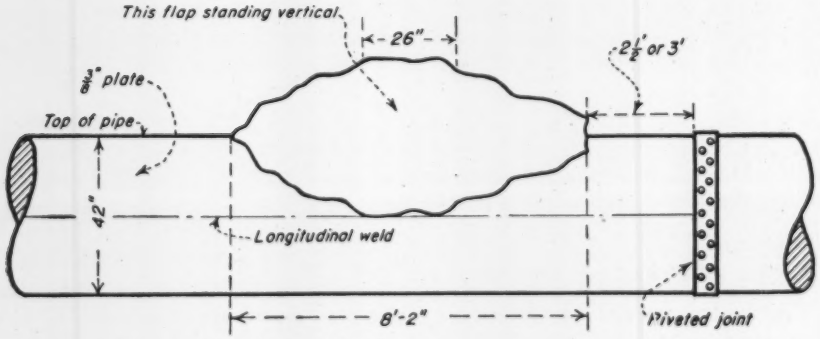
Penstocks Nos. 1 and 2, the older of the four lines, do not have expansion joints and hence for most of their length were covered by backfill. Much of this backfill was washed away by the flood released by the break in the pipe. The resultant flow of mud and boulders was responsible for extensive damage.

In addition to the deep dents in lines 1 and 2, line No. 3 suffered damage where an expansion joint was pushed out of line some 10 in. at a point about half way between the top of the penstock and the powerhouse. This damage was caused by large boulders loosened by the flood that lodged against the expansion joint where they were subjected to the high-velocity flow. Some of the supporting piers were also undermined in the flood.

Repair of the penstock called for two new sections of pipe in line 2 to replace the ruptured section and a badly dented section just above the break. It was also necessary to renew a short section in penstock No. 1 where a joint was damaged by the boulder.

The most serious damage was caused in the powerhouse. Operators had enough warning to shut down units 2, 3, and 4 but the arrival of the mud flow, bursting in the doors and blocking the controls, prevented shutting down unit No. 1 which continued to run under water and muck for about an hour until the penstock had drained. No. 2 unit was partially inundated. Boulders weighing several tons broke into the powerhouse and debris 5 to 6 ft. deep was left around generator No. 1 and about 3 ft. deep at generator No. 2. Generators 1 and 2 were damaged to such an extent that armatures and field coils may have to be rewound.

Units Nos. 3 and 4 were undamaged. As No. 4 has a rated capacity of 28,000 kw., as compared to 18,000 kw. each for the other three, this made it possible to put the greater part of the total output back on the line in a short time. The large No. 4 unit was in service again two days after the accident and the No. 3 unit was placed in operation Apr. 18 after repair of the damaged expansion joint in No. 3 penstock.



Sketch with principal dimensions at the point where No. 2 penstock was damaged and ruptured under a pressure of about 200 psi.

Septic Sewage Has a High Chlorine Demand

The chlorine demand and sulphide content of sewage increases with its septicity, according to findings made by H. Heukelekian of the department of sewage research of the New Jersey Agricultural Experiment Station, which were presented before the recent meeting of the American Chemical Society.

In fresh sewage, reported Dr. Heukelekian, nearly all the chlorine demand is due to substances other than sulphides. In septic sewage, 20 to 27 percent of the chlorine demand is due to sulphides, the balance of the demand being due to other reducing substances that react with chlorine. These relative percentages remain constant irrespective of the stage of septicity and despite the increase in chlorine demand.

In order to remove the sulphides completely from septic sewage, 75 percent of the chlorine demand has to be satisfied in contrast with the 20 to 40 percent required only for sulphide production prevention. The higher percentage required along with the higher chlorine demand of sewage necessitates the addition of ten times as much chlorine for the removal of sulphides after they are produced, in comparison with the preventive method of application to the fresh sewage.

The wastage of chlorine, said Dr. Heukelekian, is due to the fact that only 25 to 30 percent of the chlorine added reacts with the sulphides.

From Field and Office

WORKING PROBLEMS AND TIME-SAVING METHODS FOR ENGINEERS AND CONTRACTORS

Curvature of Highways

The following may be a convenient method in preparing highway plans for drawing a curved line through three points when the radius of the curve is too great for the center to be accessible and the plotted points are too far apart for the usual curved templates to be used to run the line in by trial.

Given the three points, A, B and C. Draw lines AB and AC, and measure angle ϕ between them with a protractor. Scale *BC*, and determine the desired radius of the curve passing through the three points by means of the following formula:

$$R = \frac{BC}{2 \sin \phi}$$

THOMAS C. COLEMAN, *Junior Civil Engineer, Massachusetts Dept. of Public Works, Boston 14, Mass.*

Job-Made Device Protects Truck Tires from Sharp Coral

A simple job-made device built at a cost of less than $5 to reduce damage from sharp coral rock to the tires of dual-wheeled Army carryalls and trucks is resulting in large maintenance savings. The gadget, which was invented by Warrant Officer Heimo Raski, U. S. Army, consists of a 3¼-in. metal bar attached in a manner to prevent stones from becoming wedged between the tires as shown in the illustration.

Raski's invention was first used in July, 1943, when he was with the 46th Engineer Construction Battalion on Kiriwana Island. The battalion, which had the gadget accredited by general headquarters in the Pacific, used it to protect tires from coral rock in the atolls. Since his original diagram was filed, Raski's idea has been adopted by Army commands all over the Pacific.

After drawing plans for his gadget, Raski turned it over to Sgt. Wilson Smith, for mass production. Sgt. Smith, who works in the 46th's Engineers, heavy equipment shop, was a welding engineer at the Puget Sound Navy Yard before induction.

Raski, a corporal at the time he introduced his invention, has since been transferred back to the States on rotation. Now in charge of heavy equipment dumps at New Orleans, he was awarded the Legion of Merit for his services in the Pacific.

CAMERA MEMORANDUM

A Navy Construction Battalion in the Pacific used a piece of sheet pile bolted to the wale to hold long sheets in line while they were being driven.

A steel bar mounted as shown eliminates excessive damage from sharp rock forced between the tires of dual-wheeled Army equipment.

TRACTOR THAT ALMOST FLOATS

Signal Corps photo from Army Engineers

Extensions of wood bolted to regular treads make a swamp buggy of a tractor. Some of 60-in. timbers are removed to show manner of attachment.

Comment and Discussion

Readers' opinions on matters that concern engineers and contractors

Construction Course Offered

Sir: The comment by Commander Kravath, *ENR* April 4, 1946, vol. p. 500, regarding the desirability of a college course in "Construction Machinery" is well founded. Stanford University has anticipated such a demand and beginning with the autumn quarter of 1946, in addition to the regular undergraduate course in civil engineering, will offer a "Construction Option" in the 4-year program leading to the degree of B.S. in civil engineering.

The requirements for the construction option will be the same as those for the regular civil engineering course, except that a few advanced math and design courses have been replaced by courses in the following:

(1) Construction Estimates and Costs
(2) Construction Equipment and Methods
(3) Engineering Accounting
(4) Business Law
(5) Industrial Relations

Further information on this program may be obtained by writing to F. E. Terman, Dean, School of Engineering, Stanford University, Calif.

C. H. Oglesby
Asst. Prof. of Civil Engineering, Stanford University

Hoosac Tunnel Operation

Sir: The brief article describing new ventilating equipment for the Hoosac Tunnel (*ENR* March 7, vol. p. 346) fails to mention the reason for the new ventilating equipment, which is of some interest. For many years past, electric locomotives have been coupled to the steam locomotives passing through the tunnel to make it unnecessary for them to operate in the tunnel.

Since the railroad electrification comprised the tunnel only, the load factor was extremely low and the energy cost correspondingly high. As soon as WPB restrictions were removed, the railroad obtained enough diesel locomotives to operate the entire Fitchburg Division, replacing all steam locomotives. The diesels move through the tunnel under their own power, hence the new ventilating equipment. The electrification ceased operation in November, 1945, and is now dismantled.

To my knowledge, this is the first instance of an Eastern railroad operating an entire division with nothing but diesel power.

James Wilson
Flushing, N. Y.

Compressed-air Caisson Depths

Sir: A claim of world-record depth of 123 ft. below water level in a caisson founded by pneumatic methods is made in the caption to a photograph of the Santa Fe Railway Bridge at Topock, Ariz., on page 112 of your issue of Feb. 7, 1946.

May I remind you that in the summer of 1939 some 60 caissons for which I was responsible were founded at great depths by compressed-air for the foundations of the Criminal Courts Building, Center Street, New York, six of them at depths between 125.9 and 133.0 ft. below tidewater level. (*ENR* April 13, 1939, p. 34.)

S. C. Doughty,
Chief Assistant Engineer Admiralty Rock Works Kirkwall, Orkney Islands

"Cantilever" Action in Buildings In Earthquake Zones

Sir: On February 14 Seattle experienced a quite vigorous earthquake. All its homes and buildings, large or small, suddenly and unexpectedly became vertical cantilevers subjected to shearing and bending stresses by having their normally "fixed" ends jerked and shifted sideways by the irresistible ground movements. Maximum stress occurred where it always does in cantilevers.

There have been numerous buildings of late years in various parts of the world whose ground stories appear capable of resisting little more than vertical loads. In warm or tropical climates spacious cool areas at street level, out of the glaring sun, are assuredly pleasing. Likewise pleasing to some is that type of modern architecture in which the ground story framing consists principally of columns of minimum size. If such construction is carefully *designed* against all reasonable contingencies, well and good, but if not—then not so good. It's a good idea occasionally to scrutinize one's assumptions and see if anything has been left out.

Homer M. Hadley
Regional Structural Engineer Portland Cement Association Seattle, Washington

Kingsley Dam Filter

Sir: The article "Kingsley Dam Gets a New Stone Facing," *ENR* Jan. 10, 1946, vol. p. 29 describes how precast concrete riprap has had to be replaced by quarried stone placed on a filter cushion. Although the article implies that the concrete was not satisfactory, the failure was due to a washing out of the material from underneath the precast concrete units. Apparently no reverse filter was placed under the original riprap.

The necessity—not just desirability, but necessity—of having a reverse filter underneath riprap is too often overlooked. It is to be regretted that the importance of such a reverse filter was not properly emphasized in the Kingsley Dam article.

John B. Drisko
Maplewood, N. J.

Longest European Bridge

Sir: In the article on vol. p. 208 of your February 7 issue it is stated that the railroad bridge across the Hollandsche Diep at Moerdijk in Holland is the longest in Europe. This is not so. The longest bridge in Europe is the combined road-rail bridge across the Storstrom in Denmark; it is some 10,500 ft. long, having 50 spans (*ENR* July 6, 1939, vol. p. 15). It was built in 1933-36 by the British firm of Dorman, Long & Co., to the design of the Danish engineer, Prof. Anker Engelund.

The main spans of the Forth Bridge in Scotland total 5,350 ft., which is also considerably longer than the 4,650 ft. of the Moerdijk Bridge.

Ralph Freeman
Freeman, Fox & Partners London, England

Book Notes and Reviews

The month's addition to the engineer's reading and reference list

Rigid Frame Analysis

STATICALLY INDETERMINATE STRUCTURES—By Lawrence C. Maugh. 388 pp. John Wiley & Sons., New York 16; Chapman & Hall, Ltd., London. $5.

Engineers are becoming increasingly aware of the fact that the analysis of rigid frames and other continuous structures need not involve intricate computations. Credit for this is mainly due to the method of moment distribution by successive approximations. Hence, "Statically Indeterminate Structures," which deals with the solution of structural problems by this method, should prove of value to designers as well as to students.

Emphasis is properly placed by the author on fundamental principles and adherence to a few general methods of analysis, although sometimes the illustrative methods he selected are not the shortest. Among the numerous types of structures treated are rigid-frame bents, multi-story buildings, gable frames, arched bents and continuous trusses. In several cases, Mr. Maugh introduces some novel procedures of his own creation that are worthy of note, particularly the one for analyzing Vierendeel (quadrangular-panel) trusses. While, in general, explanations of methods used are easy to follow, there are a number of places where the text could be made much clearer by more extensive treatment.

Water Bacteriology

WATER BACTERIOLOGY, Sixth Edition—By Samuel C. Prescott, Charles-Edward A. Winslow and Mac H. McCrady. 368 pp. John Wiley & Sons, New York 16, N. Y. $4.50.

Although the title of this work has been abbreviated from "Elements of Water Bacteriology", under which previous editions were published, this new volume contains more than double the material formerly included. Of particular value to laboratory analysts, research workers and students, the revised edition covers virtually every public health phase of water bacteriology. Distribution, behavior, and sanitary significance of bacteria introduced into water from extraneous sources are exhaustively discussed; and chapters are included on sewage bacteriology and shellfish examination. For those interested in the best current practice of American sanitary science, special attention is given the details and techniques of recognized tests and reactions. A prominent feature is the book's bibliography, probably the most comprehensive one in print covering the field.

Engineers and Scientists

THE ENGINEER IN SOCIETY—By John Mills. 196 pp. D. Van Nostrand Co., New York, N. Y. $2.50.

Here is a discussion of engineers and scientists that should be read by every member of either group who takes an interest in his profession as a unit in society. Young men starting out to build a career in engineering or in scientific work should find the author's discussion of compensation in research work and engineering of practical value.

Older engineers may not find as much of practical value to them in the book, but they will find it good reading. The author's basic theory is that the world would be greatly improved by an engineering or scientific approach to its problems. Hence he would like to see engineers and scientists take a much more active part in national affairs than they have in the past.

As an example of what he seeks, Mr. Mills cites the recent pronouncement of the Association of Oak Ridge Scientists with respect to atomic energy. That organization has pioneered in a direction that Mr. Mills hopes scientists and engineers will follow. However, he states that he doubts that they will ever contribute to broader social problems "until they have demonstrated an ability to handle as a class their more selfish and immediate problems."

First among these immediate problems is a more adequate share in the "new wealth uncovered by the cooperative efforts of scientists and engineers". As a preliminary step toward obtaining better pay, Mr. Mills would have engineers and scientists organize; not in trade unions, but in a voluntary association that could make a scientific study of their own situation with respect to compensation and its relation to society as a whole.

Mr. Mills rejects the major engineering societies as the agency to make this study. "The vestrymen of those organizations too completely represent the vested interests. . . . They represent their companies, I am afraid, more than they do engineers." The organization, Mr. Mills envisions, would be made up exclusively of "those creatively concerned who carry on research, development and design." He would exclude minor executives and even "coming executives" because "climbing executives fail to see those in the lower ranks."

A scientific study that will turn a spot-light on the low average pay of engineers and scientists while at the same time revealing how much they contribute to national wealth will make it possible for the organized engineers and scientists to work for more adequate compensation. And this work, Mr. Mills believes, will inevitably turn the scientific reasoning of these men to other and broader national problems, with great benefit to everyone.

Mr. Mills recognized that he has proposed an idealistic organization of ideal engineer-scientists. As a first step toward attaining his ideal he would have the every-day engineer or scientist learn to write and speak more effectively. About a third of his book is devoted to the subject of clear thinking and effective exposition.

The book's chief value lies in the fact that its idealism is seasoned with much common sense.

Building Code Problems

YOUR BUILDING CODE—By Miles L. Colean. 29 pp. National Committee on Housing, 512 Fifth Ave., New York 18, N. Y. 35c.

BUILDING CODE MODERNIZATION—70 pp. American Iron and Steel Institute, New York 1, N. Y.

Widespread interest in building code revision gives unusual significance to the two pamphlets listed above.

Miles L. Colean, in his discussion of building codes, points out that the criticisms now being leveled at such

codes as being too restrictive, requiring wasteful quantities of scarce materials and increasing the cost of construction are not new. Building code virtues, he holds, outweigh their faults. He then proceeds to discuss six major faults of building codes, indicating how they can be corrected.

Eight bulletins covering technical phases of building regulation and based on a long-term study of practices throughout the United States are included in the pamphlet issued by the American Iron and Steel Institute. To answer questions frequently raised when modernization of a building code is undertaken, the bulletins present data on the purpose and legal limitations of buildings codes, contents and arrangement of such codes, building classification, fire hazards, fire protection, exit regulations, and structural standards for hot-rolled steel shapes, light-gage steel, steel piles and metal veneers. There also is a section on ventilating and heating ducts.

New England Transportation

STEELWAYS OF NEW ENGLAND—Alvin F. Harlow. 461 pp. Creative Age Press, New York. $3.50.

THE ROLE OF TRANSPORTATION IN THE DEVELOPMENT OF VERMONT—William J. Wilgus. 104 pp. Vermont Historical Society, Montpelier, Vt. $3.

Two books about the development of transportation in the New England States have been published recently. The larger one, "Steelways of New England", is concerned chiefly with the railroads of the whole region, while the smaller book is centered on Vermont but covers highways and water transport as well as railroads. However, as Vermont transportation is of necessity closely related to that of its neighboring states and Canada, Colonel Wilgus includes in his book quite a little about areas beyond the Green Mountain State. And because his subject is broader, part of what he has written carries the reader back into the days before the Revolution and during the Revolution when there were no railroads and when the trails and rough roads and waterways of Vermont were of greater significance nationally than they are today.

Mr. Harlow's book is the first of a series of 16 books to be known as "The Railroads of America Series". It is full of interesting and little known history about the people who built the railroads of New England as well as the railroads themselves. Of special value are its many illustrations.

Miscellaneous Notes on Booklets and Reprints

BUILDING CONSTRUCTION COST DATA—1946, an annual listing of spot prices on a wide variety of building construction items can now be obtained from R. S. Means, P. O. Box 62, Duxbury, Mass., $1.60.

NEW SPECIFICATIONS for asphalt paving have been issued by the Asphalt Institute as follows: Construction specification A-2-a for hot-mixed, hot-laid asphaltic concrete paving (dense graded aggregate type); and Construction Specifications A-2-b for hot-mixed, hot-laid asphaltic concrete pavement (graded aggregate type). Also issued is a pamphlet on the inspection of these types of pavement. Copies of these specifications will be sent without charge to engineers of state and county highway departments and city public works departments by the Asphalt Institute, 801 Second Ave., New York 17, N. Y.

"WATER SUPPLY DATA OF THE UNITED STATES" is a 68-page booklet just publicly issued by the American Iron and Steel Institute, showing the trend toward corrective water treatment in the United States. The booklet contains data on 8,431 water supply sources, including all important cities and some smaller towns of interest, in each case showing the source of supply, the general characteristics of the raw and treated waters, and the type of treatment given. A limited number of copies are available to water supply engineers from George D. Lane, American Iron and Steel Institute, 350 Fifth Avenue, New York 1, N. Y.

PILE FOUNDATIONS AND PILE STRUCTURES, which has just been published as Manual No. 27 of the American Society of Civil Engineers, contains the results of a study extending over ten years made by a joint committee representing three of the society's technical divisions. A vast amount of theoretical information and practical experience has been condensed into useful form in the 72 pages of this pamphlet. Preliminary drafts of chapters relating to pile-driving formulas were published in the *Proceedings* of the society for May 1941, to stimulate discussion, which discussion was reviewed by the committee before putting the manual in final form. (Copies can be obtained from the ASCE headquarters, 33 West 39th St., New York 18, for $1.10).

New Engineering Books

THE BUSINESS LAW OF AVIATION—By Gerald O. and Lillian G. Dykstra. 523 pp. McGraw-Hill Book Co., New York 18. $5.

STATISTICAL THERMODYNAMICS — Erwin Schrodinger. 88 pp. Cambridge University Press, Cambridge, England and The MacMillan Co., New York 11, N. Y. $1.50.

BRICK STRUCTURES—HOW TO BUILD THEM—11th Edition. By Ralph P. Stoddard. 169 pp. McGraw-Hill Book Co., New York 18, N. Y., and London. $2.00.

BAUSTATIK—I—By Fritz Stussi. 368 pp. Verlag Birkhauser, Basel, Switzerland. 34.50 Swiss francs.

THE BIG ROAD—A narrative poem about the Alaska Highway. By Norman Rosten. 233 pp. Rinehart & Co., New York. $2.50.

PERSONALITY AND ENGLISH IN TECHNICAL PERSONNEL—Philip McDonald. 424 pp. D. Van Nostrand Co., New York, N. Y. $3.75.

GEOLOGICAL INVESTIGATION OF THE ALLUVIAL VALLEY OF THE LOWER MISSISSIPPI RIVER—Harold N. Fisk. 78 pp., numerous maps and plates. Mississippi River Commission, Vicksburg, Miss. Limited edition.

A MASTER PLAN FOR THE PHYSICAL DEVELOPMENT OF THE CITY—280 pp. City Planning Commission, Richmond, Va.

SOILS, CONCRETE AND BITUMINOUS MATERIALS—A Record of a course dealing with airfield construction given at the Road Research Laboratory, July-August 1943. 288 pp. Department of Scientific and Industrial Research, London. Price 10 shillings. Obtainable through G. E. Stechert & Co., 31 East 10 St., New York 3, N. Y.

Reports and Pamphlets

SCHEDULE OF MINIMUM FEES AND SALARIES—New York State Society of Professional Engineers, Grand Central Terminal, New York 17.

PENNSYLVANIA'S SECOND YEAR AT WAR—By S. K. Stevens, Marvin W. Schlegel and Joseph T. Kingston. Pennsylvania Historical & Museum Commission, Harrisburg.

PROCEEDINGS OF THE TWENTY-THIRD ANNUAL CONVENTION—1945. American Institute of Steel Construction, Inc.

(*Continued on p. 149*)

WHEN YOU START THAT NEW BUILDING USE

SCHRAMM AIR COMPRESSORS

Savings afforded you by Schramm Air Compressors will warrant your using them to get all the compressed air you need in your future construction work.

When you are able to get as much air as you need . . . wherever and whenever you need it . . . your job becomes so much easier! And the features of Schramm Air Compressors are designed for easy operation!

Features worth noting in Schramm: both engine and compressor 100% watercooled; (2) vertical cylinders, cast en bloc, afford the most compact design with no overhanging or projecting parts; (3) compact, lightweight and vibrationless; (4) mechanical intake and exhaust valves are the last word in design and efficient operation.

Write today for the new Schramm Catalog. Here you will find complete details for any type of air compressor you need, both stationary and portable.

SCHRAMM INC.

THE COMPRESSOR PEOPLE
WEST CHESTER
PENNSYLVANIA

MATERIALS AND LABOR PRICES

Market quotations on construction materials and wage rates reported monthly by ENR correspondents

LUMBER again led the price rise in June. Since the OPA has permitted a discretionary increase in the price of Douglas fir of $5.50 on board and $4.50 on dimension, the price of fir rose in all of the reported cities. In addition, the price of Southern pine showed a marked increase in Atlanta, Baltimore, Cincinnati, Dallas and Pittsburgh. WELDED STEEL FABRIC base increased 8.2 percent over the May price.

Warehouse prices of STRUCTURAL SHAPES and REINFORCING BARS rose in Atlanta, Baltimore, Dallas and St. Louis, while EXPANDED METAL LATH rose in Atlanta, Baltimore and Pittsburgh. The greatest increase in expanded metal lath was a jump of $6.60 per 100 sq.yd. at Pittsburgh. A sharp rise in the price of ASPHALT was apparent in Boston, Dallas and Pittsburgh, while the price in Kansas City decreased due to a reduction in freight rate. CARPENTERS WAGE RATES increased in Birmingham, Chicago, Detroit, Kansas City and Minneapolis.

CEMENT, AGGREGATE, READY-MIXED CONCRETE—F. O. B. CITY

	PORTLAND CEMENT — Per bbl., C/L lots, incl. bbl. for bags, cash dis. not deducted			SAND AND GRAVEL — Per ton, carload lots			CRUSHED STONE — Per ton, carload lots		CRUSHED SLAG — Per ton, carload lots, f.o.b. plant		CONCRETE BLOCK — 8x8x16-in.; truckload del.; per block		READY MIXED CONCRETE 1:2:4, over 50 c.y., del.
	Cloth [a]	Paper	Bulk	Gravel, 1½ in	Gravel, ¾ in	Sand	1½ in	¾ in	1½ in.	¾ in.	Sand-grav.	Lt.wgt Agg.	
Atlanta	$2.77	$2.52	$2.43	$1.79	$1.89	$1.65	$1.79	$1.89	$1.59	$1.69	$0.17	....	$9.00
Baltimore	2.62	2.37	2.12	1.80‡	1.80‡	1.30‡	1.80‡	1.80‡	1.75‡	1.75‡	.125	$0.125*w*	7.45
Birmingham	2.50	2.25	2.10	1.75	1.75	1.50	.85	1.00	.90	1.15	.1425	....	8.95
Boston	2.79*b*	2.72*b*	2.52	1.50*dd*	1.50*dd*	1.40*dd*	1.25*dd*	1.35*dd*	....	....	.13	.155*w*	7.55*m*
Chicago	2.90	2.65	2.50	2.15‡*d*	2.15‡*d*	2.15‡*d*	2.15‡*d*	2.15‡*d*	1.75‡	1.75‡	.18	.18*x*	....
Cincinnati	2.51	2.26	2.06	1.20	1.20	1.10	1.80	1.80	....	....	.13	.17*w*	6.85
Cleveland	2.59	2.34	2.19	1.75*i*	1.75*i*	1.25/1.65*i*	1.80*i*	1.80*i*	1.15	1.15	.14	.14	8.15
Dallas	2.51	2.26	2.06	1.80*p*	1.80*p*	1.45*p*	1.72*p*	1.82*p*	....	....	.15	....	8.20
Denver	3.59	2.92	2.47	1.20	1.25	.90	1.65	1.75	1.00	1.00	....	.155	8.75
Detroit	2.59	2.34	2.16	1.75	1.75	1.55	2.25	2.25	2.00‡	2.00‡	.14	.15*w*	7.69
Kansas City	2.78	2.57	2.38	1.85	2.30	1.00	1.91	1.91	....	....	.165	.165*wcy*	7.80*n*
Los Angeles	3.10*v*	2.50*v*	....	1.50	1.50	1.35	1.50*f*	1.50*f*	....	....	.125*bb*	.125*aa*	8.20
Minneapolis	3.37	3.12	....	1.00*h*	1.00*h*	.25*h*	1.00*h*	1.00*h*	....	....	.155	....	7.60*t*
Montreal	....	1.95*r*	1.79*r*	1.65‡*s*	1.65‡*s*	1.50*t*	.80*et*	.90*et*	....	....	.1924	.17*wt*	7.00*ls*
New Orleans	2.41	2.16	1.92	1.67	1.65	1.22	....	....	.90	1.15	.19	....	9.25
New York	2.85‡	2.60‡	....	1.74*deu*	1.74*deu*	1.07*deu*	1.80*de*	1.80*de*	....	....	.16	.14*wcc*	8.25*kq*
Philadelphia	2.73‡	2.48‡	2.28‡	1.55‡	1.65‡	1.20‡	1.90‡	1.95‡	1.10	1.10	.155	.155*w*	8.55
Pittsburgh	2.80	2.55	2.35	1.65‡	1.65‡	1.95‡	2.25‡	2.25‡	1.50	1.50	.21	.21*z*	8.85
St. Louis	3.08*o*	2.80*o*	....	1.75‡*o*	1.75‡*o*	1.65/1.75‡*o*	1.25/1.95*c*	1.25/1.95*c*	.90*g*	1.15*g*	.155	.18*yo*	8.60
San Francisco	2.21	2.01	1.71	1.36	1.36	1.36	1.46	1.46	....	....	....	.215*y*	7.55
Seattle	....	2.75*o*	....	2.35*d*‡	2.35*d*‡	2.35*d*‡	2.85‡*od*	2.85‡*od*	....	....	.16	....	7.25

‡ Delivered. *a* 10c allowed for each returnable bag. *b* 10c per bbl. off for cash. *c* F.o.b. quarry. *d* Per cu. yd. *e* Barge lots alongside docks. *f* Crushed granite. *g* F.o.b. Granite City, Ill. *h* F.o.b. plant. *i* Within three miles of Public Square. *j* 5% discount for cash. *k* Discount of 2 percent for cash in 10 days. *l* 2000 lb. concrete. *m* 50c off for cash. *n* 25 c.y. or more. *o* 2% off for cash. *p* 10c per ton off, cash 15 days. *q* 5 cu. yds. or more. *r* 10c per bbl. off, cash 20 days. *s* 8% sales tax included. *t* 8% sales tax not included. *u* In outlying New York districts, price is $1.89. *v* 20c. per bbl. discount; 80c. per bbl. for bags. *w* Cinder. *x* Waylite. *y* Haydite. *z* Celocrete. *aa* Pumice. *bb* 6 x 8 x 12 in. *cc* Also 8 x 18 in. *dd* Prices last month were quoted retail in error. *ee* In outlying New York districts, price is $1.22.

CASH DISCOUNTS CEMENT to Contractors: truck delivery 2% for cash on 10th of month; on carload deliveries, no trucking, same as dealer cash discount. 10c per bbl for payment within 15 days of date of invoice. Subject discount 10c per bbl 20 days in Montreal.

CURRENT MAXIMUM PRICE BASES AT CEMENT MILL

Charge for bags not included. For cloth bags, add 40c. per bbl.; 10c. refund allowed for each returnable bag; for paper bags add 15c. per bbl., not refundable.

	Bagged	Bulk		Bagged	Bulk		Bagged	Bulk
Buffington, Ind.	$1.90	$1.85	Ironton, Ohio	$1.80*	$1.75*	Universal, Pa.	1.85	1.80
Hannibal, Mo.	1.90	1.85	Northampton, Pa.	1.75	1.70	Waco, Tex. (Plus 9c tax in Tex.)	1.75	1.70
Independence, Kans.	1.90	1.85	Richard City, Tenn.	$2.00	$1.95	Montreal City (Discount 10c. per bbl 20 days)	1.68	1.67
			Steelton, Minn.	2.00	1.95			

* Destination price base: effective Sept. 17, 1945.

PAVING BRICK, BLOCK, ASPHALT, ROAD OILS—F. O. B. CITY

	PAVING BRICK AND BLOCK			PAVING ASPHALT — Per ton, less than 80 penetration		ASPHALT BINDERS—FLUXES — Per gal., 80–300 penetration		CUTBACK ASPHALT — Per ton		ROAD OIL — Per gal.	ASPHALT EMULSION (Quick-breaking) — Per gal.	
	Granite, per M lots of 50,000 4x4x8 in.	Brick, per M 3x4x8½ in. carload lots	Wood, per sq. yd. 3½ in. 16-lb. treat	Tank car	Drums	Tank car	Drums	Tank car	Drums	Tank car	Tank car	Drums
Atlanta	$73.00	....	$2.25	....	$14.00	$0.074	....	$0.0806*h*	....	$0.0781	$0.0806	....
Baltimore	150.00‡	49.00	85.00*m*	15.00*r*	21.00*r*	.06*r*	0.09*r*	13.00*r*	23.00*r*	.06*r*	.07*r*	.14*r*
Birmingham	150.00	32.00*j*	....	17.95	....*l*	.0747	....*l*	.0834*h*	....*l*	.065	.095	....*l*
Boston	85.00	59.00	3.75	16.00	25.00	.0675	.12	18.00	31.00	.0675	.0875	.15
Chicago	150.00‡	60.00‡	2.85/4.00*d*	15.00	23.50	14.15*g*	22.65*g*	.0625*h*	.155*h*	.05	.09/.10‡	.13/.15‡
Cincinnati	120.00	55.75	....	17.00	....	.085	....	12.25	....	.07	.085	....
Cleveland	127.50	39.00	3.59	17.00	19.00	.085	.095	.10*h*	.11	.08	.10	....
Dallas	....	40.00	....	15.36	22.70	.0618	.12	17.95	28.00	.06	.0725	.135
Denver	....	....	....	....	....	....	....	....	....	....	....	....
Detroit	....	37.00	....	17.60*r*	26.56*f*	.0734	.128	.0718*h*	.119*h*	.067	.0974	.135
Kansas City	....	44.00	....	15.00*u*	20.60*u*	....	....	.07*h*	.0675*hu*	....	.11	.14*u*
Los Angeles	....	50.00	....	9.00*b*	23.00*b*	9.50*bg*	24.00*bj*	9.50*b*	....	.03*b*	.08*b*	.16*b*
Minneapolis	....	....	2.017*d*	....	27.70	....	.126	....	32.64	....	....	....
Montreal	70.00	....	....	16.60*k*	24.25*k*	.1035*k*	.111*k*	.115*hk*	.135*hk*	.08*k*	.135*k*	.188*k*
New Orleans	....	....	....	13.50*a*	20.00*a*	.057	.088	.06*h*	.095*h*	....	.080	....
New York	....	65.00	....	18.40	28.25*s*	.0734*t*	....	.0746*h*	.1248*h*	.0671	.0754	.1259
Philadelphia	150.00	62.00	4.06	16.00	....	15.00	....	.0675*h*	....	....	14.00*gr*	....
Pittsburgh	135.00	39.75	3.75	19.00	25.00	.095	.17	21.00	38.00	.075	.085	.14
St. Louis	....	40.00	....	14.80	19.80	13.80*g*	18.80*j*	.0587*h*	.1362*h*	.483	.07	.1215
San Francisco	....	45.00*c*	....	11.75	21.00	11.75*g*	....	13.75	....	....	.0525	.1125
Seattle	....	....	....	11.75*t*	22.75*t*	9.50	21.20*p*	12.25*t*	14.75	11.75*t*	.0525*t*	.0625*t*

‡ Delivered. *a* F.o.b. Baton Rouge. *b* F.o.b. Refinery. *c* 2¼ × 8¼ × 4 in. *d* 2-in. interior block, 6-lb. treatment. *e* 3¼ × 4 × 8¼. *f* Mexican. *g* Per ton. *h* Per gallon. *i* F.o.b. Martinez. *j* 3 x 3¼ x 8¼ in. *k* Tax included. *l* Quoted on request only. *m* Per thousand. *r* February 1943 prices, none later available. *s* Price quoted last month was not F.O.B. city. *t* Price quoted last month was price per ton. *u* Reduction from last month's price is due to lower freight rates.

IRON AND STEEL PRODUCTS—BASE MILL PRICES

	STRUCT. SHAPES-PLATE	REINF BARS ¼-in billet *b*	RIVETS ½-in structural	WIRE NAILS Base	SHEET PILING Base	STEEL RAILS Per Net Ton Standard	Light	Re-rolled	TRACK SUPPLIES Angle Bars	Std Spikes *c*	Tie Plates *c*	Track Bolts
Birmingham	$2.35	$2.35	$3.75	$3.25	....	$43.39	$49.18	$48.29	$2.70	$3.65	$2.55	$4.75
Chicago	2.35	2.35	3.75	3.25	$2.65	43.39	49.18	48.29	2.85	3.65	2.55	4.75
Pittsburgh	2.35	2.35	3.75	3.25	2.65	43.39	49.18	48.29	2.85	3.65	2.55	4.75
Buffalo	2.35	2.35	....	....	2.65	.....	.....	.....	....	....	2.55	....
Cleveland	....	2.35	3.75	3.25	....	.....	.....	.....	....	....	....	....
Youngstown	....	2.35	....	....	....	.....	.....	.....	....	3.65	....	....
Detroit	....	2.45‡	....	....	....	.....	.....	.....	....	....	....	....
Gulf ports	2.60*a*	2.70*a*	....	....	2.85*a*	.....	.....	.....	....	....	....	....
Pacific ports	3.00*a*	2.75*a*	....	3.75*a*	3.20*a*	.....	.....	.....	....	3.90	2.70	....

‡ Delivered. *a* F.o.b. cars dock. *b* Rail steel same as billet prices. *c* Other basing points include Portsmouth, O., Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., and Pacific coast ports, on tie plates alone. Steelton, Pa., on spikes alone, Lebanon, Pa., Richmond, Va. *d* Add switching charge $18 per cl.

IRON AND STEEL PRODUCTS—F. O. B. WAREHOUSE, PER 100 LBS., BASE PRICE

	STRUCTURAL SHAPES Per 100 lb base price	REINFORCING BARS *g* Per 100 lb., ¾ in., base price 15 tons or over *b* New billet	Rail steel	Add Switch	$/cwt. for Del.	EXPANDED METAL LATH Per 100 sq. yd., carload lots Std. diamond mesh, 3.4 lb	Std ribbed 3.4 lb.	WELDED FABRIC REINFORCING Per 100 sq ft., carload lots 4x16 in., No. 5 & 10 wires	4x12 in., No. 8 & 12 wires	6x6 in. No. 6 & 6 wires Per 100 s. f.	SHEET PILING Per 100 lb base price
Atlanta	$2.57	$2.64	$2.64	$.025	$.10	$23.16	$25.30	$1.95	$1.45	$2.05	$3.35
Baltimore	3.909	3.344	3.25	....	.10	24.50	26.50	1.83	1.37	1.93	3.25
Birmingham	2.35*a*	2.15	2.15	.025	.10	19.00	21.00	1.93	1.44	2.03	....
Boston	4.162‡	4.194‡	....	$20 C.L.	.10	18.50	20.50	1.89	1.41	1.98	3.02
Chicago	2.35*a*	2.35*a*	2.35*a*	.03	.05	21.50‡	23.50	1.80	1.35	1.89	2.65
Cincinnati	3.841	2.86*cd*	2.86*cd*	....	.05	....*n*	....*n*	1.79	1.35	1.88	....
Cleveland	3.838	4.00	3.98	.025	.10	20.50	24.50	1.79	1.35	1.88	....
Dallas	5.25	4.17	4.17	....	....	25.50	27.50	2.06	1.52	2.17	....
Denver	4.83	4.54	....	....	....	35.00	35.00	2.10	1.55	2.21	....
Detroit	3.911‡	2.70‡	2.70‡	....	.10	25.00	30.00	1.81	1.36	1.90	2.91
Kansas City	4.44	2.75*cd*	2.75*cd*	.0	.05	25.50	27.50	1.91	1.43	2.01	3.062
Los Angeles	4.45*f*	3.025	2.487	.025	.05	23.00	27.50	2.06	1.52	2.17	4.45
Minneapolis	4.122‡	2.99	2.99	.0	.10	21.00	23.00	1.93	1.44	2.03	3.04*d*
Montreal	3.95*i*	2.90*i*	2.80*i*	....	....	31.00*hi*	46.00*hi*	2.89	3.54*i*	2.96*im*	....
New Orleans	4.408‡	3.84	4.108	.05	.10	22.00	24.00	1.95	1.45	2.05	3.125
New York	4.008	2.96*e*	2.96*e*	....	.15	17.50	19.50	1.85	1.39	1.95	2.74
Philadelphia	3.916	3.868	....	....	....	20.50‡	22.50‡	1.84	1.38	1.93	2.97
Pittsburgh	2.35*a*	2.35*a*	2.35*a*	.025	.10	23.00	26.50	1.72	1.30	1.81	2.65
St. Louis	3.697	2.94	2.94	.0	.05	28.00	34.00	1.82	1.37	1.92	2.70
San Francisco	4.15	3.025	2.875	.025	.10	22.00	25.50	2.06	1.52	2.17	3.20
Seattle	3.00*e*	3.00*e*	....	....	....	36.50	38.00	2.06	1.52	2.17	3.20*e*

‡ Delivered. *a* Mill prices. *b* 5-15 tons, add 15c. 1-5 tons, add 25c. Less than 1 ton, add 50c. *c* 20 tons or over Base. *d* Mill price plus freight. *e* F.o.b. dock. *f* Includes delivery in free delivery zone. *g* High scrap steel prices cut former 15c. differences between new billet and rail steel in many mills. *h* List price. *i* Plus Dominion and Province sales tax. *m* Per sq. yd. *n* Practically no carloads are available. Retail price delivered is $27.00 for std. diamond mesh and $29.00 for std. ribbed.

PLUMBING, HEATING, WATER, SEWER AND DRAIN PIPE

	C. I. PIPE Per net ton f.o.b. 6 in. to 24 in. *a*	VITRIFIED SEWER PIPE Per foot, std. 8 in., s.s.	Delivered std. 12 in., s.s.	ASTM 24 in.	C13-35 36 in.	CLAY DRAIN TILE Per 1,000 ft., carload lots, f.o.b. 6 in.	8 in.	CONCRETE SEWER PIPE Per ft., delivered; ASTM C 14-35 12 in.	24 in.	WROUGHT STEEL PIPE Full standard weight, *h* 1 to 3 in., Butt Weld Black %	Galv. %	3½ to 6 in.: Lap Weld Black %	Galv %
Atlanta	$58.40	$0.43	$0.67	$3.39	....	$110.00	$140.00	$0.45	$2.00	65.5	54.5	63.5	53.0
Baltimore	62.80	.35	.60	2.70	$7.25	160.00	200.00	.75	2.00	65.5	57.5	63.0	54.5
Birmingham	54.00	.275	.495	1.95	5.50	100.00	220.00	.50	1.75	62.2	54.2	59.7	51.2
Boston	65.00	.392*r*	.756*r*	3.15*r*	7.995*r*	170.00‡*r*	265.00‡*r*	.53	2.04	....	....	....	....
Chicago	62.80	.40	.675	2.70	7.00	110.00‡	150.00‡	.45	1.85	63.0	52.0	61.5	50.0
Cincinnati	61.80	.308	.594	3.42	8.20	97.30	149.40	.36	1.60	51.5	39.4	51.4	36.0
Cleveland	63.20	.301*r*	.548	2.15	5.535	138.50	216.60	.36	1.60	68.5	57.5	66.0	54.5
Dallas	64.78	.365	.657	2.664	6.00	108.00	130.00	.46	1.57	....	....	....	....
Denver	69.62	.34	.612	2.52	....	154.00‡	264.00‡	.52	2.00	44.0*a*	30.25*a*	40.5*a*	25.25*a*
Detroit	63.20	.42	.81	3.15	8.50	170.00‡*r*	263.00‡*r*	.36	1.60	54.1	40.3	50.9	36.5
Kansas City	64.12	.35	.59	2.20	6.20	160.00	286.00	.45	1.60	60.5	49.5	57.8	46.3
Los Angeles	76.00	.325†	.585†	2.70	6.75	130.50	217.50	1.00†	2.00†	....	....	....	....
Minneapolis	66.10	.305†	.549†	2.196†	6.25†	....	....	.90	2.40	60.6	49.6	57.9	46.4
Montreal	67.00	.85*o*	1.50*o*	5.25*p*	8.50*ep*	45.00*m*	64.00*m*	.811*m*	2.51*m*	....	....	....	....
New Orleans	60.40	.31	.558	3.558	....	112.00	....	....	....	58.8	47.8	56.3	44.8
New York	62.20	.46	.89	3.67	9.08	....	....	.60	1.40	61.9	50.9	59.4	47.9
Philadelphia	60.90	.385	.75	3.06	8.00	180.00	250.00	.45	1.75	52.75	39.01	49.63	35.25
Pittsburgh	63.60	.322†*r*	.621†*r*	2.7†*r*	6.625*r*	124.20	193.80	.99	2.25*g*	68.5*s*	57.5*s*	66.0*s*	54.5*s*
St. Louis	61.40	.31*w*	.558*w*	2.232*w*	4.95*w*	93.50*w*	187.00*w*	1.00*j*	2.15*k*	64.5*s*	53.5*s*	63.0*t*	51.5*t*
San Francisco	76.00	.3875*d*	.6975*d*	2.79	6.975	124.50	207.50	.58	2.34	....	....	....	....
Seattle	77.80	.4125	.77	2.98	....	115.20	....	.51*f*	1.44*f*	....	....	....	....

‡ Delivered. † F.o.b. *a* B. & S. class B and heavier. C/L lots. Burlington, N. J. (base) $59.00. Based on existing freight rates; subject to rate change. Gas pipe and class A. $3 per ton additional, 4 in., $5 per ton additional, 30 in. and larger usually $1 per ton less. *b* Double strength. *d* List. *r* 30-inch. *f* Less 5% for cash. *g* Culvert pipe. *h* Discounts from standard ist consumers carload prices, except Pittsburgh prices are f.o.b. mill. Base price $200 per net ton. List prices per ft.: ½ in. 8½c.; ¾ in., 11½c.; 1 in., 17c.; 2 in., 37c., 2½ in. 58½c.; 3 in., 76½c.; 4 in., $1.09; 6 in., $1.92; 3 per cent tax on transportation costs not included. *r* Applies also at Lorain, Ohio mills. Chicago delivered base is 2½ points less on butt. 1½ on lap. Freight is figured from Pittsburgh Lorain, O., Chicago Dist. Billing is from point producing lowest price at destination. WROUGHT IRON PIPE: Base price and list prices per ft. same as wrought steel pipe. Discount for Pittsburgh base: Butt-weld—1 in. and 1¼ in. black 34 galv. 16; 1½ in. black 38 galv. 18½; 2 in. black 37½, galv. 18. Lapweld—2½ in. to 3½ in. black 31½ galv. 14½; 4½ in.: to 8 in. black, 32½ galv. 17. *j* Reinforced; spec. C 76-37. *k* Reinforced; spec. C 75-37. *m* Centri spun. *o* Less 50%. *p* Less 53%. *r* Truck delivery. *s* Gary base. *t* Morain base. *w* Less 3% for cash.

LUMBER, TIMBER, PLYWOOD—PER M FT., B.M., CARLOAD LOTS F.O.B

	SHORT LEAF YELLOW PINE AND DOUGLAS FIR — All S. L. Y. P is No. 2 common or better and for No. 1 N. C. Box. Prices in Bold Face: All Fir ranks No.2 common. Fir timber is No. 1 common. Lengths up to 20 ft (Prices in Italics)									LONG LEAF Y P Merchantable grade up to 20 ft.		PLYWOOD Rail freight increments (See note for base price)	
	1x6 S4S	1x8 S4S	2x4 S4S	2x6 S4S	2x8 S4S	2x10 S4S	2x12 Rgh	6x12 Rgh	12x12 Rgh	2x12 Rgh	12x12 Rgh	5/8"	3/8"
Atlanta	$45.25	$45.25	$42.25	$41.75	$42.75	$45.25	.....	.....	.....	$67.00	$67.00	$17.72	$21.37
		45.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Baltimore	72.50	74.00	69.50	69.00	69.00	75.00	$85.00	.....	.....	181.00	175.00	18.45	21.995
	78.00	*80.00*	*78.50*	*77.00*	*77.00*	*78.00*	*92.00*	*$85.00*	*$83.00*	.....	.....	.....	.....
Birmingham	50.00	50.00	49.50	48.50	49.50	52.50	73.00	.....	.....	.....	.....	17.245	20.795
	55.00	*55.00*	*54.50*	*53.50*	*54.50*	*57.50*	*77.00*	*60.00*	*61.00*	*72.50*	*75.00*	.....	.....
Boston	*60.00*[g]	*60.00*[g]	*60.00*[g]	*60.00*[g]	*60.00*[g]	*62.00*[g]	*66.00*[g]	.....	.....	.....	.....	18.195	21.995
	60.50	*60.50*	*58.50*	*58.50*	*58.50*	*58.50*	*62.50*	*68.00*	*68.00*	*58.00*	*58.00*	.....	.....
Chicago ‡	65.00	66.00	62.00	62.00	62.00	69.00	75.00	.....	.....	97.00	97.00	14.555	17.555
	65.50	*65.50*	*65.50*	*65.50*	*65.50*	*66.50*	*67.50*	*68.00*	*64.00*	.....	.....	.....	.....
Cincinnati	51.00	52.50	46.00	46.00	48.00	56.00	70.50	.....	.....	68.50	68.50	17.245	20.795
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Cleveland	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	17.615	21.245
Dallas	54.50	54.50	52.75	56.75	52.25	54.00	56.50	59.50	59.50	89.75	86.00	14.555	17.555
Denver ‡	*64.25*[i]	*64.25*[i]	*64.75*[i]	*65.25*[i]	*63.75*[i]	*64.75*[i]	*68.75*[i]	*72.00*	*72.25*	.....	.....	10.285	12.435
Detroit	62.00	62.00	58.75	58.75	58.75	64.75	71.00	.....	.....	70.75	90.00	17.245	20.795
	63.50	*63.50*	*62.50*	*62.50*	*67.25*	*77.25*	*79.50*	*76.00*	*90.00*	.....	.....	.....	.....
Kansas City a	74.00	74.00	72.00	70.50	72.00	74.00	89.00	.....	.....	89.00	99.00	12.605	15.205
	76.50	*76.50*	*69.00*	*69.00*	*69.00*	*69.00*	*84.50*	*85.00*	*85.00*	.....	.....	.....	.....
Los Angeles a	*64.75*	*64.75*	*68.50*	*67.25*	*67.25*	*67.25*	*76.00*	*75.25*	*73.50*	.....	.....	9.81[gh]	11.86[gh]
Minneapolis ‡b	78.50[i]	77.25[i]	.....	.....	.....	.....	.....	.....	.....	.....	.....	13.765	16.615
‡	*82.00*	*82.00*	*76.75*	*76.75*	*76.75*	*77.50*	*76.50*	*76.00*	*76.25*	.....	.....	.....	.....
Montreal c	69.00	70.00	64.00	68.00	70.00	75.00	.....	.....	.....	.20[i]	.20[i]	.....	.....
	97.00	*97.00*	*97.00*	*97.00*	*97.00*	*97.00*	.....	*87.00*	*87.00*	.....	.....	.....	.....
New Orleans	42.00	42.00	39.00	38.50	34.00	42.00	46.00	.....	.....	54.50	69.00	14.555	17.555
	86.00	*86.00*	*84.50*	*84.50*	*83.50*	*83.50*	*83.00*	*29.50*	*29.50*	.....	.....	.....	.....
New York ‡	Range from $85.00 to $95.00						$95 to $100	.....	.....	125.00[f]	130.00[f]	18.195	21.995
‡	*Range from $96 to $121*									.....	.....	.....	.....
Philadelphia	75.00	75.00	75.00	75.00	75.00	75.00	75.00	.....	.....	130.00	130.00	18.195	21.995
	80.50	*80.50*	*79.50*	*79.50*	*79.50*	*79.50*	*89.50*	*90.00*	*90.00*	.....	.....	.....	.....
Pittsburgh	55.40	57.80	67.35	59.60	65.45	67.10	80.85	.....	.....	126.00	137.50	17.88	21.63
	73.60	*72.70*	*70.70*	*69.90*	*69.80*	*70.35*	*87.35*	*92.85*	*92.85*	.....	.....	.....	.....
St. Louis	62.25	62.25	61.25	60.00	60.95	63.00	74.25	*69.75*	*68.25*	.....	.....	14.555	17.555
Seattle d	*58.50*	*58.50*	*57.00*	*57.00*	*56.00*	*56.00*	*54.50*	*29.50*	*28.50*	.....	.....	7.33[g]	8.83[g]
	60.00[a]	*60.00*[a]	*62.25*[a]	*62.25*[a]	*51.00*[a]	*51.00*[a]	*50.75*[a]	*52.75*[a]	*57.75*[a]	.....	.....	.....	.....

Bold Face type, Southern Pine *Italics, Douglas Fir* Long leaf Roofers N. C. Pine [2] Spruce [4] Native [6] Western Pine, No. 3 Common [7] Spruce [8] Norway Pine. ‡ Delivered. *c* 5M ft. or less. *d* Mill prices to distributor. For boards add $17 M ft. bm., for small dimension lumber, $14.50/M ft. bm. for direct mill shipment bought from wholesaler (F.o.b. cars, San Francisco spotted for unloading) or for boards add $26.50, for small dimension lumber add $24/M ft. bm., from wholesale distribution yard (F.o.b. purchaser's truck or carrier, San Francisco Yard). *e* Plus sales tax. *f* Up to 18 ft. *g* Lower rate by water shipment. *h* 50,000 lb. minimum. *i* FBM scarce, no stable quotation, no ceiling.

Note: Special concrete form grade Fir Plywood, 4' by 8' panels, 5-ply, sanded 2 sides, water resistant glue carload lots, delivered per 1,000 sq ft surface. Seattle base price on ¼". $95.15; on ¾". $104.85; price includes oiling and sealing charges. For other centers add rail freight increment from table or proper size. For resin dipped treatment, add $10.50 per M

GLASS, EXPLOSIVES, CHEMICALS

	WINDOW GLASS — Discounts from jobbers list Aug. 15, 1938 Single or Double Thickness: A quality	B quality	EXPLOSIVES — Per lb 40% Ammonia Gelatin in 50-lb cases delivered in 200 lb lots*
Atlanta	74%	75%	$0.16
Baltimore	78%	79%	.16
Birmingham	76%	76%	.115
Boston	77%	78%	.16
Chicago	77%	77%	.16
Cincinnati	77-10%	77-10%	.16
Cleveland	77%	77%	.20
Dallas	76%	76%	.1675
Denver	76%	76%	.165*e*
Detroit	77%	77%	.1675
Kansas City	77-10%	77-10%	.165
Los Angeles	86%*d*	88%*d*	.1675
Minneapolis	77%	77%	.16
Montreal	40-10-2%*ab*	50-2%*ac*	.1775†
New Orleans	70%	75%	.17
New York	80%	81%	.23*f*
Philadelphia	78%	79%	.16
Pittsburgh	79%	79%	.1325
St. Louis	77-10%	77-10%	.165
San Francisco	66%	73%	.165
Seattle	75%	75%	.1675†

Price of 60% Ammonia Gelatin is $0.01 per lb higher than 40%

a Discount from list Sept. 1939; sales tax included, but 6% tax exemption not allowed for. *b* Single thickness. *c* Double thickness. *d* Discount from jobbers' list Sept. 15, 1928

* Urban prices influenced by service charges or local storage and delivery regulations do not consistently reflect quantity prices in less congested areas. *e* F.o.b. Louviers, Colo. *f* In boroughs of Kings, Queens and Richmond, and in Manhattan south of Canal St. add delivery charge of $6.00 per trip. † F.o.b. 40% Ammonia Gelatin price ranges in other than urban areas, per lb.

(except Seismograph Grades)	C/L 20,000 lb net	Tons	200 lb. lots
E. of the Miss., except Fla and Me	$0.105	$0.13	$0.15
W. of Miss. to Rocky Mtn. States, Fla. and Maine	.11 -.1175	.135 -.1175	.155 -.1675
Rocky Mtn. States	.11 -.1225	.135 -.1525*e*	.155 -.1725*e*
Pacific N. W. States	.1075-.12	.1375-.15	.1575-.17
Pacific S. W. States	.1050-.1125	.135 -.1425	.155 -.1625

e F.o.b. Louviers, Colo. or Butte, Mont.

PILES, TIES F.O.B.

PILES

Prices per linear foot, fir and pine, bark on, f.o.b. cars, New York. Fir based on Wash. and Ore. points to New York shipping area; pine based on freight from Norfolk

Dimensions	Points	Length	By Rail — Pine *	Fir
12-in. at butt	6-in.	30 to 50-ft.	$0.34	.....
12 in. — 2 ft. from butt	6-in.	50 to 59-ft.	.35	.....
12-in. — 2 ft. from butt	6-in.	60 to 69-ft.	.36	.....
12-in. — 2 ft. from butt	6-in.	90 to 100-ft.	...	.54
13-in. — 3-ft. from butt	5-in.	91 to 100-ft.	...	.56
14-in. — 2-ft. from butt	6-in.	50 to 69-ft.	.41	.63
14-in. — 2-ft. from butt	6-in.	70 to 79-ft.	.43	.57
14-in. — 2-ft. from butt	5-in.	80 to 85-ft.	.54	.....
14-in. — 2-ft. from butt	5-in.	85 to 89-ft.	.57	.....
14-in. — 2-ft. from butt	5-in.	90 to 100-ft.	...	.62

* Pine piling over 80-ft. available only in limited quantities.

RAILWAY TIES

Prices f.o.b. per tie for carload lots:		6'x8'x8' Untr.	6'x8'x8' Tr.	7'x9'x8'6" Untr.	7'x9'x8'6" Tr.
Boston	Oak	$1.50	....	$2.00	....
	Pine	2.00	$3.00*a*	2.50	$3.00*a*
New York	S. L. Sap Pine	1.43/1.54	2.59	1.76	2.86
	Mixed Oak	1.71	2.59	2.42	3.58
Birmingham	Hardwood	1.00	1.60*a*	....	2.25*a*
Chicago	Red Oak	....	2.45/2.65*a*	....	3.35/3.60
Los Angeles	Douglas Fir	2.10	3.35*a*	3.00	4.80*a*
Philadelphia	Red Oak	....	2.10*ag*	....	3.25*ag*
St. Louis	White Oak	1.70	....	2.40	....
	Red Oak	1.63	2.15*a*	2.19	3.25*a*
	Sap Pine or Cypress	1.70	....	2.06	....
San Francisco	Douglas Fir	1.25*bef*	....	....	3.00*ca*
Montreal	Birch or Maple	....	1.65	1.04	....

Tr — Treated; Untr — Untreated *a* Creosoted *b* 6'x8"x8'6" *c* Empty cell *d* Zinc - Green *f* F.o.b. cars † Out of market *g* January 1943 price, none later available

CHEMICALS

Water, sewage treatment, road work, f.o.b. carlots, New York	
Bleaching powder, in drums, f.o.b. works, per 100-lb	$2.50- 3.10
Chlorine cylinders, liquid, per lb., delivered	.0523
Calcium chloride, 77-80% flaked 100-lb. paper bag, del'd. ton	18.50-35.00
Silicate of soda, 52 deg. in drums, f.o.b. works, per 100 lb.	1.40
Soda ash, 58%, in paper bags, per 100 lb. dense	1.15
Sulphate of aluminum, commercial, in 100-lb. bags, per ton	23.00-25.00
Sulphate of copper, in bbl., per 100-lb	5.00

STRUCTURAL CLAY BUILDING TILE, BRICK AND LIME — DELIVERED

	STRUCTURAL CLAY TILE PARTITION — SCORED Per M lots of 2,000 pieces or over. 3x12x12 in	4x12x12 in	8x12x12 in	STRUCTURAL CLAY TILE — LOAD BEARING — SCORED Per M lots of 2,000 pieces or over 8x12x12 in	10x12x12 in	12x12x12 in	BRICK Per M in quantity Common backing	Straight hard	LIME Per ton, Hydrated finishing	In paper Common hydrated	Carload lot Pulverized or lump
Atlanta	$110.00	$130.00	$230.00	$240.00	$270.00	$300.00	24.00	$24.00	$19.00	$17.50	$17.50
Baltimore	90.00	95.00	175.00	200.00	260.00	300.00	23.75*k*	29.75*k*	20.00	15.00	2.50*m*
Birmingham	80.00	85.00	160.00	191.00	252.00	288.00	18.50	23.00	18.11	14.05	15.05 18.95
Boston	105.00†	112.00†	210.10†	252.09†	.....	.....	20.00*k*	20.00*k*	21.00†	.....	16.00
Chicago	85.80	91.70	172.60	.....*x*	.....*x*	.....*x*	17.00	18.00	17.00	15.00	12.50
Cincinnati	65.55	69.90	131.20	148.70	210.35	240.45	27.75	27.75	15.50	13.00	.....
Cleveland	98.10	104.56	.....*x*	.....	.....	.....	22.75	22.75	15.75	13.25	.....
Dallas	77.25	83.00	165.00	198.00	254.50	315.00	17.25	19.00	19.00	15.00	15.00
Denver	105.20	119.00	198.25	230.00	263.50	315.25	24.00	.....	30.00*c*	24.00*c*	26.00
Detroit	92.70	96.70	174.50	198.80	257.20	294.30	23.25*f*	23.25*f*	20.00	18.00	18.00
Kansas City	67.00	69.00	89.00*c*	128.00	163.00	189.00	17.50	18.50	19.32	13.00	10.92
Los Angeles	82.50*tr*	97.50*tr*	135.00*ctr*	210.00*tr*	368.00*tr*	460.00*tr*	16.50	18.50	16.50	17.50	17.50
Minneapolis	.....	113.00*b*	186.25*b*	112.00*cc*	.....	.....	18.50*s*	.....*g*	24.00	16.00	19.00
Montreal	92.50*s*	98.50*s*	196.25*s*	151.50*s*	100.50*st*	134.50*sc*	22.16†*s*	33.20†*s*	24.60*s*	15.00*s*	14.00*s*
New Orleans	104.50	109.55	207.25	222.25	326.90	385.65	17.75	.....	18.30	12.08	14.10
New York	99.40*z*	106.00*z*	145.75*cz*	156.60*hn*	.....*x*	.....*x*	23.00	.....	20.00	14.00	17.00
Philadelphia	112.10	119.60	224.20	269.10	321.20	405.10	20.75	23.75	22.00	18.00	17.00
Pittsburgh	88.50	94.30	176.85	212.30	260.85	298.10	23.25	25.25*y*	17.90	15.40	2.55*m*
St Louis	67.00	72.00	130.00	190.00	244.00	290.00†	23.50*s*	22.50*s*	22.00*s*	18.00*s*	.....*x*
San Francisco	102.40	115.20	153.60	115.20*r*	.....	.....	21.00	.....	18.50	18.50	1.85*m*
Seattle	121.00	133.00	.....*x*	133.00*cc*	.....	.....	22.50*k*	27.75*k*	20.00*s*	20.00*s*	3.00*m*

† F.o.b. *a* Smooth *b* Carload lots delivered to job *c* 6x12x12 in., 3-cell *cc* 5 x 8x12. *f* Includes $3.50 per M. for delivery *g* No quotation. *h* F.o.b. Perth Amboy N. J. *i* F.o.b. Warehouse only. *j* OPA Price *k* $1.00 discount *m* Per bbl., 180 lb *n* 7⅝ x 7⅝ x 12 Speed tile. *o* Per bbl., 200 lb *r* 5% discount 10 days. *s* 2% discount for cash *t* 5½ x 8 x 11½ *u* 8% sales tax included *z* sand lime. *x* Not available *y* Stacked *z* Subject to 20—25% increase.

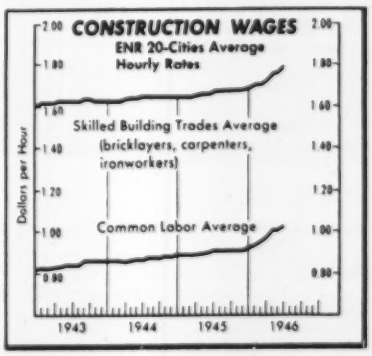
PAINT, ROOFING — F.O.B. CARLOAD LOTS

	RED LEAD Per 100 lb in 600-lb. (Approx.) bbl. Dry *a*	WHITE LEAD Per 100 lb in oil	READY-MIXED PAINT Graphite *b*	Per gal., drums Aluminum *c*	Ferric Oxide *d*	ROOFING SUPPLIES Carload lots f.o.b. factory Rolls, slate surfaced, 85-90 lb. per sq	Asphalt felt, per 100 lb.	Tar felt, per 100 lb.	Asphalt coating per gal.	Tar pitch 360 lb. bbl. per ton
Atlanta	$10.25	$14.125	$1.30	$2.25	$1.20	$2.06	$2.06	$2.06	$1.00	$36.00
Baltimore	10.00	13.75	2.00	3.00	2.50	2.35	2.90	2.90	.40	29.00
Birmingham	10.25	14.125	2.25	3.53	1.98	2.09	1.98	1.98	.32	28.35
Boston	10.00	13.75	1.75	2.50	2.31	2.00‡*k*	3.30‡*us*	3.30‡*us*	.25‡	21.00‡
Chicago	10.00	13.75	....	....	....	1.75*kf*	1.74*kf*	1.82*kf*	.33*f*	23.00*f*
Cincinnati	10.00	13.75	1.70	2.905	1.60	2.20	2.10*k*	2.10*k*	.33	25.00
Cleveland	10.00	13.75	1.70	2.90	1.60	1.80	1.71*k*	1.71*k*	.237	25.00
Dallas	10.00	14.50	1.88	2.11*n*	.05*l*	1.75*k*	1.66*k*	1.66*k*	.35	39.00
Denver	10.00	14.25	1.80	13.2*k*	16.15*k*	3.00	1.92*k*	1.92*k*	.29	29.00
Detroit	10.00	13.75	1.75	3.00	1.60	2.25	2.25	2.25	.50	23.00
Kansas City	10.00	13.875	2.30*g*	2.55*g*	2.16*f*	2.19	2.30	2.30	.28	27.50
Los Angeles	10.25	14.25	2.00	2.60	2.50	2.10	1.50	.....	.45	.....
Minneapolis	10.00	13.875	....	....	....	1.7123*k*	1.6243*k*‡	1.6243*k*‡	.32	23.00
Montreal	.....	11.05	2.50*p*	4.90*p*	3.15*p*	2.71	2.45*t*	2.45*t*	.84*t*	1.83*k*
New York	10.00	13.75	2.03	....	1.82	1.9006	1.8468*o*	1.8468*o*	.26	23.00
Philadelphia	10.00	13.75	1.60/1.80	2.20	1.55	2.25	2.71	2.71	.32	23.00
Pittsburgh	10.00	13.75	1.50	2.10	1.25	2.15	2.05*k*	2.05*k*	.34	26.00
St. Louis	10.00	13.75	2.28*s*	2.89*s*	1.96*s*	1.71*k*	1.70*k*	1.70*k*	.38	22.00
San Francisco	10.25	14.00	1.80	2.75*n*	1.35	1.71	2.40	2.40	.33	20.50
Seattle	10.25	14.25	1.90	3.00	....	2.15	2.16*k*	....	.35	31.00*f*

‡ Delivered Note: Red lead in oil 50c higher than white lead in oil *a* Red lead prices change frequently due to pig lead price changes *b* U. S. War Dept. Spec. 3-49A *c* ASTM Spec. D266-31 *d* 80% minimum ferric oxide *f* Distributors' price to contractors. *g* 55 gal. can *k* Per roll, 65 lb *s* Minneapolis and vicinity *t* Asphalt pitch *k* Per 100 lb *l* Per lb. *n* May, 1941 price *o* 60-lb roll *p* Plus 8% sales tax *s* December, 1942 price *t* Federal tax included *u* 90-lb roll *z* Truck delivery

SKILLED AND COMMON WAGE RATES — PER HOUR

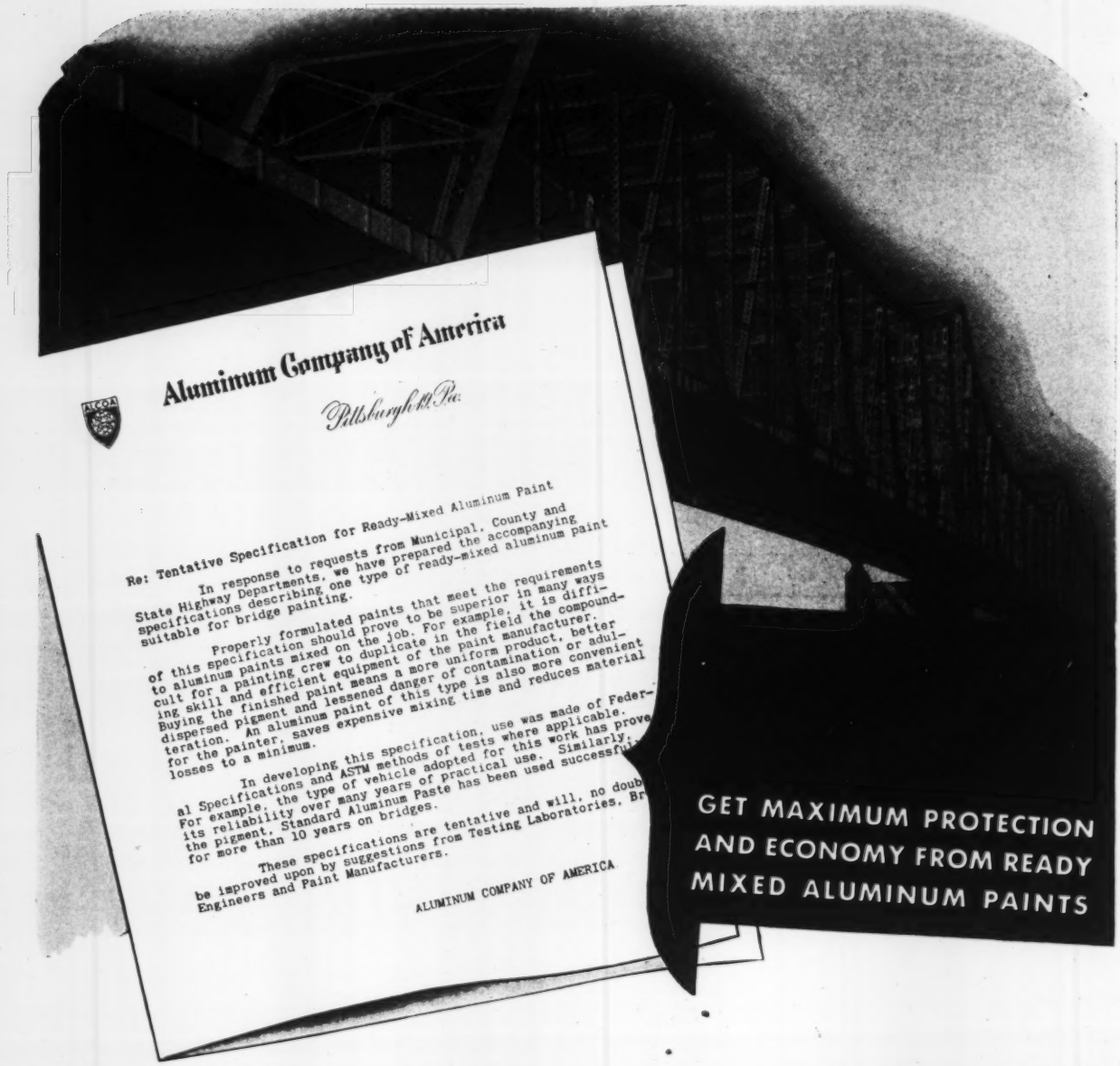
	Bricklayers	Carpenters	Struct. Iron Workers	Hoisting Engineers	Plasterers	Common Labor Building	Common Labor Heavy Const.
Atlanta	$1.75	$1.50	$1.625	$1.50	$1.50	$0.65	$0.80
Baltimore	1.90	1.675	1.90	1.625/2.00	1.725	.95	.95
Birmingham	1.9375	1.50	1.625	1.50	1.65	.65	.65
Boston	1.725	1.60	1.725	1.65	1.667	1.15	1.15
Chicago	2.00	1.95	1.88	1.95	1.90	1.20	1.20
Cincinnati	1.875	1.65	1.775	1.875/2.125	1.875	.95	.95
Cleveland	2.00	1.65	2.00	2.00	2.00	1.25	1.25
Dallas	1.937	1.425	1.625	1.625	1.75	.80	.80/1.25
Denver	1.80*b*	1.625	1.50*b*	1.625*b*	1.90	1.00	1.00
Detroit	1.90	1.75	1.825	1.675/1.825	1.90	1.15	1.15
Kansas City	2.00	1.75	1.875	1.875	2.00	1.175	.90
Los Angeles	1.875	1.50	1.75	1.50	1.90	1.25	1.25
Minneapolis	1.825	1.65	1.75	1.60	1.725	1.01	1.01
New Orleans	1.625	1.375	1.625	1.55	1.50	.70	.80
New York	2.25*b*	2.10*b*	2.25	2.25	2.25*b*	1.75	1.20
Philadelphia	2.00	1.775	1.90/2.00	2.25	2.00	1.025	1.025
Pittsburgh	2.00	1.75	1.75	1.875	1.875	1.00	.90
St. Louis	2.00	1.95	2.00	2.20	1.90	1.20	1.20
San Francisco	2.05	1.75	1.75	1.60/2.00	2.00	1.0625	1.0625
Seattle	1.91	1.61	1.81	1.90	1.91	1.21	1.21
Montreal*	1.16	1.02	1.07	1.07	1.12	.61	.68



b 7 hr. day * Cost of living bonus now included in basic wage

ENR Skilled Average: (Bricklayers, Carpenters, Ironworkers) $1.798

ENR Common Average: $1.0335


Aluminum Company of America
Pittsburgh 19, Pa.
Re: Tentative Specification for Ready-Mixed Aluminum Paint
In response to requests from Municipal, County and State Highway Departments, we have prepared the accompanying specifications describing one type of ready-mixed aluminum paint suitable for bridge painting.
Properly formulated paints that meet the requirements of this specification should prove to be superior in many ways to aluminum paints mixed on the job. For example, it is difficult for a painting crew to duplicate in the field the compounding skill and efficient equipment of the paint manufacturer. Buying the finished paint means a more uniform product, better dispersed pigment and lessened danger of contamination, or adulteration. An aluminum paint of this type is also more convenient for the painter, saves expensive mixing time and reduces material losses to a minimum.
In developing this specification, use was made of Federal Specifications and ASTM methods of tests where applicable. For example, the type of vehicle adopted for this work has proved its reliability over many years of practical use. Similarly, the pigment, Standard Aluminum Paste has been used successfully for more than 10 years on bridges.
These specifications are tentative and will, no doubt be improved upon by suggestions from Testing Laboratories, Bridge Engineers and Paint Manufacturers.
ALUMINUM COMPANY OF AMERICA
GET MAXIMUM PROTECTION AND ECONOMY FROM READY MIXED ALUMINUM PAINTS

If you are one of those who must buy on specification only, this "Tentative Specification for Ready Mixed Aluminum Paints" may guide you to new economies. As its preface states, "Properly formulated paints that meet the requirement of this specification should prove superior in many ways to aluminum paint mixed on the job . . . it is difficult to duplicate in the field the compounding skill and efficient equipment of the paint manufacturer . . . more uniform . . . better dispersed pigment . . . less adulteration. Also . . . more convenient, saves mixing time, reduces material losses . . ."

This is not an effort to change your mind if you are an advocate of job-mixed aluminum paints. But it presents an opportunity to take advantage of recent improvements in pigment and vehicles. Either way, Alcoa Albron pigment, made of aluminum more than 99% pure, assures painting satisfaction. ALUMINUM COMPANY OF AMERICA, 1812 Gulf Building, Pittsburgh 19, Pennsylvania.

ALCOA ALBRON PASTE

ALCOA ALUMINUM

Elections and Activities

The Toncan Culvert Manufacturers Association recently held its first national meeting since 1941. The association is composed of representatives of fabricating companies using Toncan iron, a product of Republic Steel Corp. in building culverts and other drainage products. The association has set up national headquarters at 1112 Standard Building, Cleveland, Ohio.

Harold J. Bair

Harold J. Bair, president of the Empire State Culvert Corp., Groton, N. Y., was elected president of the association; O. H. Miller, president of Choctaw, Inc., Memphis, Tenn., vice-president and N. J. Thompson, sales manager of Thompson Pipe and Steel Co., Denver, Colo., secretary and treasurer.

The Connecticut Society of Civil Engineers has elected F. Walden Wright, Hamden town engineer, as president. Other officers: First vice-president, Albert A. Cross, West Hartford; second vice-president, William A. D. Wurts, Hartford. New directors are: William S. Wise, West Hartford; Kenneth H. Holmes, New London; Russell G. Warner, New Haven, and Melville F. Taylor, Stamford.

The General Contractors' Association of Milwaukee, Wis., elected the following officers:—president, W. H. Emory; vice-president, T. L. Cottam; secretary-treasurer, Leo P. Bauer; directors, Wm. F. Kachel and John Dahlman, Jr.

Carleton S. Finkbeiner, newly elected president of the Toledo, Ohio, Chapter, American Society of Civil Engineers has announced committees as follows: R. E. Brown is chairman of the program and entertainment committee. Other chairmen are R. W. Abbott, publications and publicity; S. C. McKee, junior engineers; W. S. Smith, engineering education; W. P. Sanzenbacher, auditing and financing; George N. Schoonmaker, new members; H. P. Jones, professional conduct; R. A. Nyguist, veterans in the construction industry, and Mr. Abbott, delegate to the Toledo Technical Council.

At the recent 11th annual convention of the Pennsylvania Society of Professional Engineers in Reading, Pa., the principal addresses were given by Col. Frederick A. Muhlenberg, recently district engineer in Cincinnati for the U. S. Engineer Corps, who covered developments in the field of atomic energy and W. A. Hardenbergh, formerly colonel and chief engineer of the U. S. Army Sanitary Corps, who spoke on sanitary engineering.

Capt. Frederick H. Dechant of the U. S. Naval Reserve, described the huge floating drydocks used during the war which did in five days the work that would have taken five weeks if the ships had returned to bases for repairs. The membership committee reported 348 new members during the last year.

An Association of Connecticut Street and Highway Officials was organized recently at Hartford, Conn., under the sponsorship of the Connecticut Highway Safety Commission. Representatives from 20 Connecticut towns and cities were present. Officers elected were: President, Royal W. Thompson, superintendent of streets, Hartford; vice president, E. C. Gleason, street commissioner, Norwalk; secretary-treasurer, Albert A. Donnelly, maintenance director, State Highway Department. The board of governors include: E. B. Sullivan, East Hartford; Leon Booth, Hamden; Leon E. Tuttle, Stamford; P. L. Allen, New London; Ira M. Hoyt, Litchfield; Samuel C. Cannon, Middletown; and George Milne, Rockville.

The Wisconsin Concrete Products Association has elected these officers: president, George Andrews, Fond du Lac; 1st vice-president, William Siegert, Milwaukee; 2nd vice-president, Arthur Grube, Sheboygan; secretary-treasurer, A. W. Devos, Milwaukee; and directors, Otto Lodwig, Milwaukee; William Schneider, Milwaukee; Elmer Strong, La Crosse; Herbert Loucks, Madison; and Harry Sorenson, Racine.

Officers of the U. S.-Mexico Border Health Association have been nominated as follows: President, James R. Scott, state health officer of New Mexico; vice-president George W. Marx, director of sanitary engineering of the Arizona Health Department; second vice-president Luis Arriaga, state Health officer of Chihuahua; secretary, James A. Grider, El Paso, Tex.; assistant secretary, Andres Lasaga, Juarez.

Carl Wischmeyer, vice-president of Rose Polytechnic Institute, Terre Haute, Ind., has been elected president of the Illinois-Indiana section of the Society for the Promotion of Engineering Education. Other officers elected were Robert T. Kintner, Illinois Institute of Technology, Chicago, vice-president; and Herman A. Meench, Rose Polytechnic Institute, secretary, the latter succeeding W. M. Lansford, University of Illinois. Named to the executive committee were R. A. Budenholzer, Illinois Institute of Technology; V. C. Williams, Northwestern University; D. T. Canfield, Purdue University; R. E. Hitchins, Rose Polytechnic Institute; W. I. Collins, University of Illinois; and J. A. McCarthy, University of Notre Dame.

Arizona Chapter, Associated General Contractors of America, has elected officers and directors as follows: President, H. L. Royden, paving and highway contractor, Phoenix, succeeding D. W. Fisher, of Fisher Contracting Co., Phoenix; vice president, P. W. Womack, Womack Construction Co., Phoenix, succeeding H. L. Royden; treasurer, M. O. Packard Jr., Packard Contracting Co., Phoenix, succeeding H. L. Royden, who held the combined offices of vice president and treasurer last year; executive secretary, Joseph P. Condrey, Phoenix, reelected. Directors are the officers and I. G. Beall, Bert M. Pringle and D. W. Fisher, all reelected except M. O. Packard Jr., newly elected member of the board, and vice-president.

E. A. Ryan, consulting engineer of Montreal, has been elected president of the Corporation of Professional Engineers of Quebec. Ernest Lavigne was elected vice-president. Other officers elected or continued in office are: G. H. Midgley, J. W. McCammon and J. A. Lalonde of Montreal, and Eugene Larochelle and Louis Beaudry of Quebec, councillors, and Marc Boyer, registrar.

Gordon J. Beiswanger of the Billings municipal water department has been elected president of the Montana Section of the American Water Works Association. He succeeds Fred Quinnell of Bozeman. Other officers are Stewart Voden, Great Falls, vice-president; H. B. Foote, Helena, secretary-treasurer, and B. F. Mercer, Sidney, and John B. Hazen, Butte, trustees.

The Montana Sewage Works Association has named Kenneth Chrysler, Billings, chairman; K. J. Winebrenner, Kalispell, vice-chairman; H. B. Foote, Helena, secretary-treasurer, and F. F. Palmer, Forsyth, F. E. Brandis, Chinook, and J. M. Schmit, Lewistown, trustees.

The Wisconsin Sewage Works Operators have elected: President, H. P. Kakuske, Janesville; 1st vice-president, L. A. Manteufel, Wausau; 2nd vice-president, H. T. Rudgal, Kenosha; secretary-treasurer, T. F. Wisniewski, Madison.

(Continued on next page)

GET MORE THAN 2000 TONS
OF MIX PER 8-HOUR DAY
IN ONE OPERATION!

...WITH WOOD ROADMIXERS

Reduction of as much as ⅔ in the total cost of a job is not infrequent when Wood Roadmixers are used. The use of low cost local or imported materials, coupled with reduced manpower, and maximum output assures economical stabilized base or road surfacing on any job—whether using road oils, emulsions, tar, or soil-cement.

The Wood Roadmixer is a complete travel mixing plant—pulled and powered by a crawler tractor. See your Wood Roadmixer dealer or write direct for literature and prices on Roadmixers, Tank Trailers, Windrowers, and V-Spreaders. 48

WOOD MANUFACTURING CO.

BOX 620, 6900 TUJUNGA AVENUE • NORTH HOLLYWOOD, CALIFORNIA

"GUNITE" CONCRETE

For ● Steel Plate Lining ● Steel Encasement ● Building Walls, Roofs, Facings ● Tunnel Lining ● Water Reservoir Lining ● Power Plants—Bunker Lining ● Sewer Repairs ● Tank Lining ● Canal and Ditch Lining ● Repairs of Disintegrated Concrete, Brick, Tile, Masonry

• • WRITE • • • PHONE • • • WIRE • •

GUNITE CONCRETE AND CONSTRUCTION CO.

1301 WOODSWETHER ROAD ● KANSAS CITY, 6, MISSOURI

DISTRICT BRANCH OFFICE: 228 N. LaSalle Street, CHICAGO 1, ILL.

BRANCH OFFICES: ST. LOUIS • DENVER • DALLAS • HOUSTON • NEW ORLEANS

Dawson Winn, vice-president of Green Lumber Co., Laurel, Miss., has been elected president of the Prefabricated Home Manufacturers Institute. Other officers are: Austin Drewry, secretary of Gunnison Homes, Inc., New Albany, Ind., vice-president; and John Pease, Pease Woodwork Co., Cincinnati, Ohio, secretary-treasurer. W. Hamilton Crawford Crawford Co., Baton Rouge, La., was elected a director. James R. Price, National Homes Corp. of Indiana, Lafayette, Ind., and Mr. Winn were re-elected directors.

The institute, a trade association of prefabricated home manufacturers in the United States and Canada, has a membership of 44, according to Harry H. Steidle of Washington, D. C., manager.

P. G. Wilmut has been elected president of the Montreal, Que., Builders Exchange, Inc., C. H. Gordon, F. R. Murray, Alex Wilson, and J. R. Hebert were elected vice-presidents.

Gen. James A. Anderson, highway commissioner, has been elected president of the Virginia Chapter, American Society for Public Administration, Russell S. Hummell, regional director of the FHA, was named vice-president. Elected to the board of directors are: Raymond V. Ling, chairman of the State Planning Board; Russell B. DeVine, member of the State Pardon and Parole Board, and Arthur S. Owens, city manager of Portsmouth, Va. The organization which has become reactivated is to aid research experts and public administrators in improving public services.

Dean Joseph Weil of the University of Florida college of engineering has been elected chairman of the Southeastern Section of the Society for the Promotion of Engineering Education.

T. C. Cooke is president of the Durham, N. C., Engineers Club. He served as treasurer during the last year and succeeds Charles B. Faucette. Other officers are: P. D. Davis, vice president, succeeding H. S. Crain; Guy H. Bennett, who was renamed secretary; and D. L. Gery, treasurer.

William R. Doar has been elected president of the Raleigh, N. C., Engineers Club, and G. R. Cherry, vice-president. F. H. Brant was re-elected secretary-treasurer.

The Wisconsin Road Builders have elected the following officers: President, Joseph D. Bonness, Milwaukee; vice-president, Arthur Overgaard, Elroy; treasurer, N. M. Isabella, Madison; C. H. Pierce, Eau Claire; and E. E. Hoebel, Madison.

BRIXMENT MORTAR

Has Better Water-Retention

Here's the way to test for high water-retention. Slap a small dab of any two mortars onto a brick. Wait a minute, then feel each dab. The one that stays plastic longest will be the one *having the* highest water-retention. *Try this with Brixment mortar!*

—AND HIGH WATER-RETENTION IS ESSENTIAL TO WELL-BONDED, WATERTIGHT MASONRY

Water-retaining capacity is the ability of a mortar to retain its moisture, and hence its plasticity, when spread out on porous brick. ● High water-retaining capacity is of *extreme importance* in mortar. If the mortar does not have high water-retaining capacity, it is too quickly sucked dry by the brick; the mortar stiffens too soon, the brick cannot be properly bedded, and a good bond cannot be obtained.

Brixment mortar has extremely high water-retaining capacity. It strongly resists the sucking action of the brick. Brixment mortar therefore stays smooth and plastic longer, when spread out on the wall. *This permits a more thorough bedding of the brick, and a more complete contact between the brick and the mortar.* The result is a better bond, and hence a stronger and more *water-tight wall.*

LOUISVILLE CEMENT CO., Incorporated, LOUISVILLE 2, KENTUCKY

CEMENT MANUFACTURERS SINCE 1830

CRISP SHARP PRINTS
EVEN IN FINE DETAILS
"VAN DYKE" EBERHARD FABER, U.S.A. — 3H

MICROTOMIC VAN DYKE by EBERHARD FABER

HI-DENSITY LEAD

an exclusive advantage, puts on paper a thinness of graphite; exceptionally smudge-free, BUT ACTINICALLY EXTRA-DENSE, therein is the secret of the better reproduction, so convincingly demonstrable. Something to look into! At accredited Dealers, in all principal cities.

18 degrees from 7B to 9H with Round Leads
6 degrees also with Chisel Point Leads.

New Aids to the Constructor

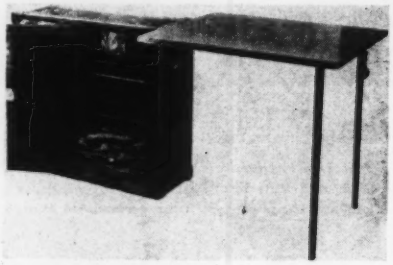
Hoist Safety Brake

A positive and entirely automatic brake, available on the Garner-Denver HKK hoist, is said to hold in suspension any load within the capacity of the hoist and cannot be released until air is admitted to the motor and the load is picked up. This spring-loaded brake is held in the off-position by air pressure; if the air supply fails or the hose or line ruptures or breaks, the brake is automatically applied. It is automatically released when the throttle valve is moved in either direction.—*Gardner-Denver Co., Quincy, Ill.*

• • •

Portable Desk

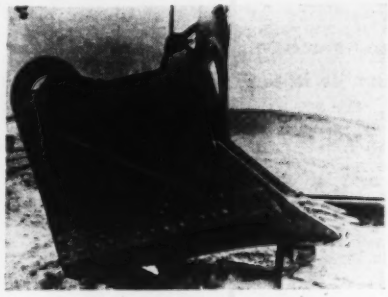
Porta-Desk, a compact, portable desk for engineers and contractors, has been designed by *R. W. Cropper*, of Kansas City, for handling correspondence and reports while in the field. The desk,



which may be quickly set up anywhere, is complete with trued drawing board and space for typewriter, T-square, filing cabinet, plans, papers, pencils and catalogs.

Weighing approximately 40 lb., Porta-Desk measures 27x29x12 in.; it fits into a carrying case that can be locked, shipped without crating, or carried in car seat or luggage compartment.—*Engineered Products Co., 1127 East 31st St., Kansas City, Mo.*

• • •



Cast-Welded Dipper

Lighter weight is the principal advantage of a cast-welded dipper. This is gained through the use of manganese steel castings in the parts subjected to the most wear and shock, while the back and sides of the dipper make use of fabrication and welding techniques. The new dipper is offered in a size range from 3/8 to 5 cu. yd. capacity and larger sizes on special order.—*Electric Steel Foundry, Portland 10, Ore.*

• • •

Synthetic Rubber Compound

A special compound which can be furnished on industrial tires of all standard sizes is said to resist the destructive action of oil, grease and brine. In addition, this synthetic rubber compound is said to have low rolling resistance and to be difficult to cut or chip.—*The B. F. Goodrich Co., Akron, Ohio.*

• • •

Control Cabinet for Water Pumping Stations

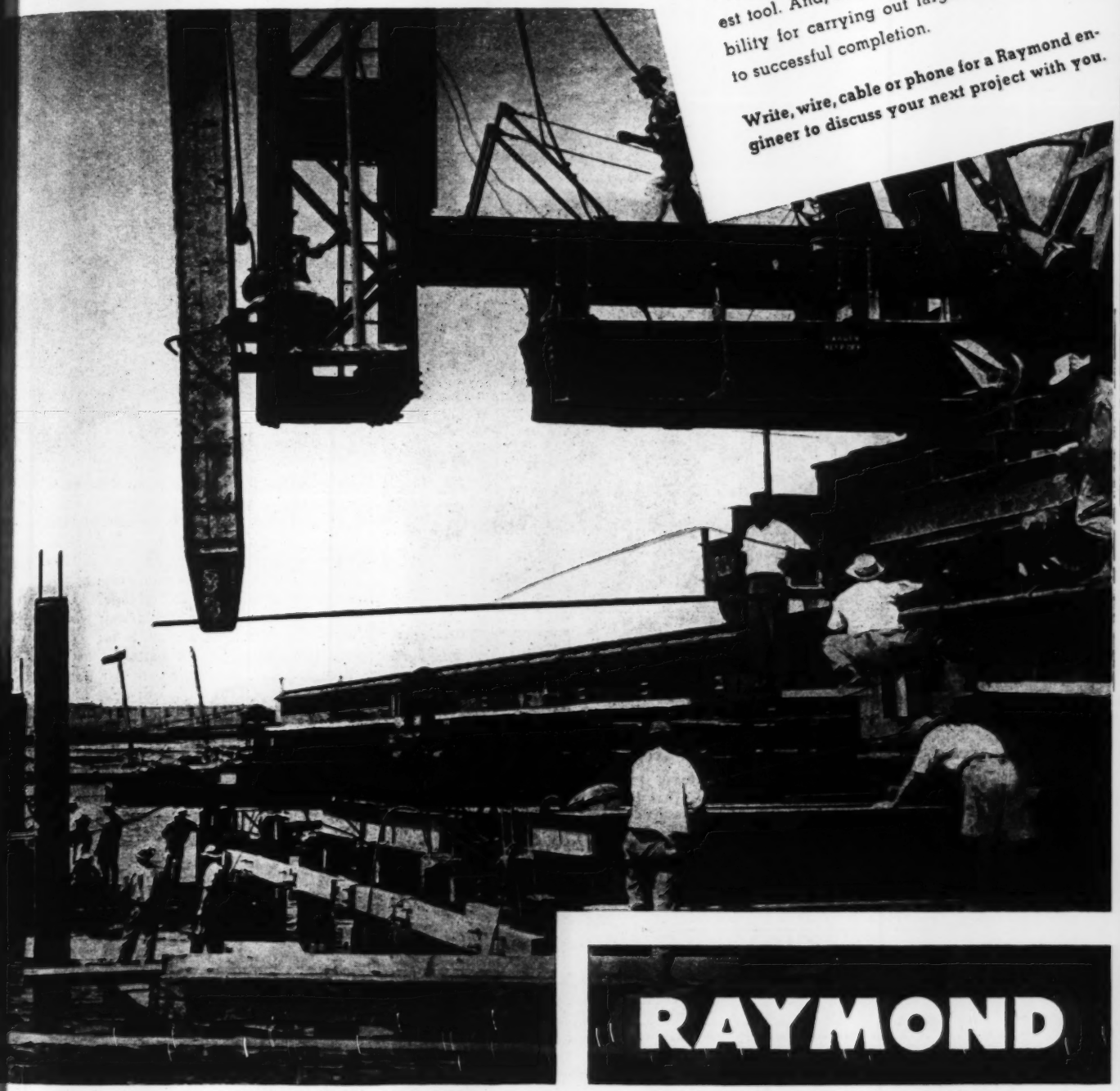
A complete, compact control unit with all instruments required for a small, isolated pumping station has been developed. An indicating Rotax altitude controller is set to start the pump at 80 ft. and stop it at 100 ft. elevation; it operates on change in pressure at the pump house corresponding to variations in level in the storage tank. A Master meter with an extra pen records, in feet of water, the elevation controlled and indicated by the Rotax controller. A draw-down indica-

EXPERIENCE

EVERY STEP OF THE WAY

RAYMOND MEN know their jobs – from the preliminary investigation of underground conditions to the complete installation of the foundation. They also know their equipment – how to handle the largest rig and the smallest tool. And, too, they know their responsibility for carrying out large and small jobs to successful completion.

Write, wire, cable or phone for a Raymond engineer to discuss your next project with you.



Driving a Pre-Cast Concrete Pile

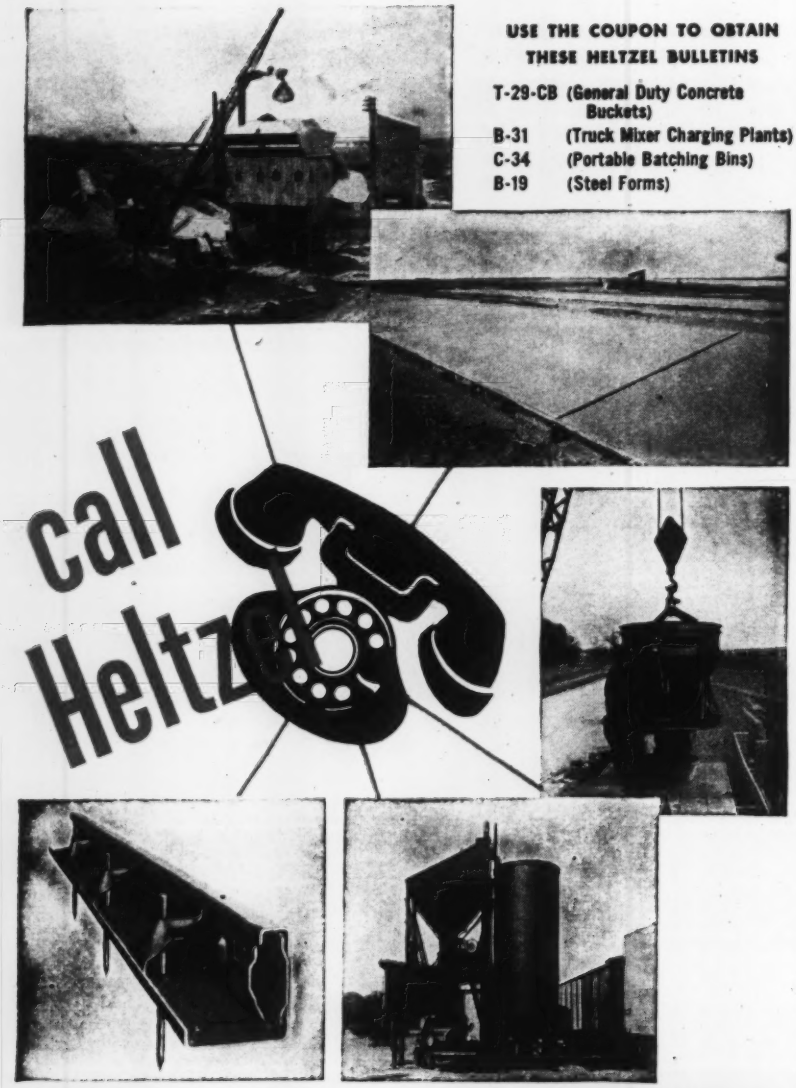
THE SCOPE OF RAYMOND'S ACTIVITIES includes every recognized type of pile foundation – concrete, composite, precast, steel, pipe and wood. Also caissons, construction involving shore protection, ship building facilities, harbor and river improvements and borings for soil investigation.

RAYMOND

CONCRETE PILE CO.

Branch Offices in Principal Cities of United States and Latin America

140 CEDAR STREET, NEW YORK 6, N. Y.



USE THE COUPON TO OBTAIN THESE HELTZEL BULLETINS

T-29-CB (General Duty Concrete Buckets)
B-31 (Truck Mixer Charging Plants)
C-34 (Portable Batching Bins)
B-19 (Steel Forms)

● Prepare for the "go-ahead" signal on concrete construction by writing or calling Heltzel now. Ask for these engineering-styled, easy-to-read, easy-to-use, Heltzel bulletins:

T-29-CB (General Duty Concrete Buckets)
B-31 (Truck Mixer Charging Plants)
C-34 (Portable Batching Bins)
B-19 (Steel Forms)

Name_____

Address_____

_____

_____

(Type of construction usually engaged in)

Heltzel

BINS, Portable and Stationary
CEMENT BINS, Portable and Stationary
CENTRAL MIXING PLANTS
BATCHERS (for batch trucks or truck mixers with automatic dial or beam scale)
BITUMINOUS PAVING FORMS
ROAD FORMS (with lip curb and integral curb attachments)
CURB FORMS
CURB AND GUTTER FORMS
SIDEWALK FORMS
SEWER AND TUNNEL FORMS
CONCRETE BUCKETS
SUBGRADE TESTERS
SUBGRADE PLANERS
TOOL BOXES
FINISHING TOOLS FOR CONCRETE ROADS

STEEL FORM & IRON CO.
WARREN, OHIO · U. S. A.

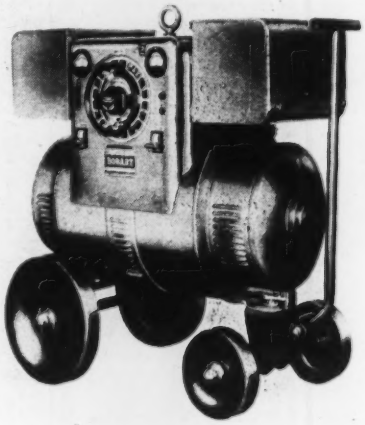
tor shows the difference in elevation of water level in the well under static and under pumping conditions.

The control cabinet, in battleship gray baked enamel finish with maroon trim, is also available in black lacquer. A "manual-off-automatic" switch can be supplied to meet engineers' specifications. —*The Foxboro Company, Foxboro, Mass.*

• • •

Battery Charger-Welder

A battery charger-arc welder may be used wherever batteries are charged and electric arc welding done. It has complete, separate control panels with instruments. The unit may be readily



switched back and forth from welding to charging.

Model 496 is a 300 ampere electric motor driven welder including MGC panel circuit for charging one railway coach battery at a maximum rate of 200 amperes at 50 volts, DC. Model 497 is 400 ampere electric motor driven welder including MGC panel circuits for charging two railway coach batteries at one time and at a maximum rate per battery of 150 amperes at 50 volts, DC. The welders are multi-range dual control electric drives with exclusive remote control and all the other improved welding features of the Hobart welding generators.—*The Hobart Brothers Company, Hobart Square, Troy, Ohio.*

• • •

Tooth Point

Distinct improvements in design and construction of tooth points for dragline service have been incorporated in a reversible center shank tooth point. The

new hook bolt fastening is so constructed that the bolt will not wear or tear loose from the point, it is claimed. Nor will the tooth point loosen or work off if 25 percent minimum bearing is maintained on the stub ends and on the shank above and below the bolt head.—*Page Engineering Co., Clearing Post Office, Chicago 38, Ill.*

• • •

Electronic Air Filter

Electro-Cell, a unit type electronic air filter, has positive and negative collector plates assembled on cross rods to form removable horizontal groups. These plate assemblies slide into the filter casing like a desk drawer, and an automatic washing

device permits them to be washed in place when manual washing is not feasible.

Standard Electro-Cell sections are 2 and 3 ft. wide, with a capacity of 1,000 cfm. per unit. There is no duplication of top and bottom sections when assembled because the filter varies in height from 27 in. to 15 ft., by 9 in. increments. In 6 ft. or higher sections, the ionizers are mounted on a bar hinge.—*American Air Filter Co., 125 Central Ave., Louisville 8, Ky.*

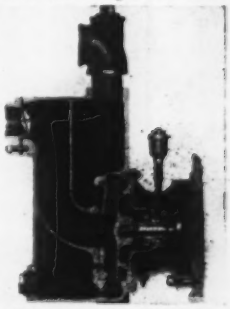
• • •

Magnetic Drill Extractor

A new magnetic device for removing drill bits, diamond bits and broken drill rod from rock drill holes is made of a new type of Alnico magnet steel, said to have nearly twice the magnetic strength of older Alnico steels. The drill extractor is capable of lifting approximately 25 times its own weight in vertical lifts, and exhibits unusual holding ability on small and uneven surfaces. Use of this device, it is claimed, often saves redrilling holes in which bits have broken off, or sections of drill rod lost.

The extractor weighs only one pound and is made in 1¼-in. and 1½-in. diameters. In use, it is fastened to the face of an old drill rod at the end of a length

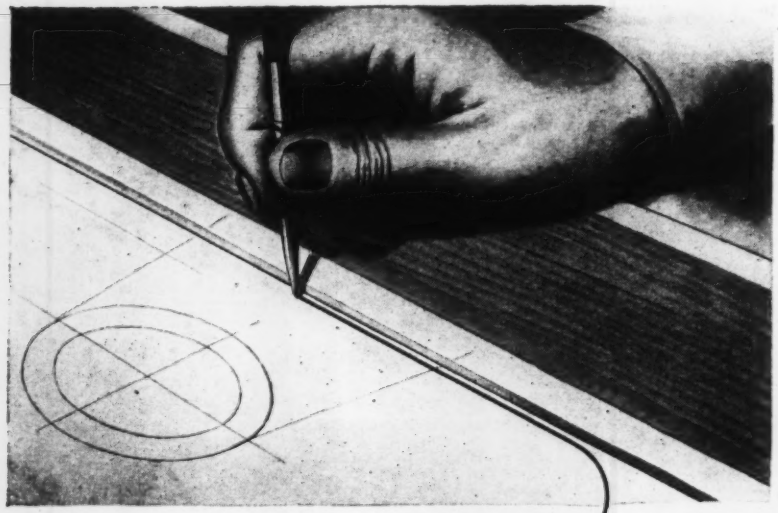
CARVER PUMPS are designed and built to stay on the job for hundreds of hours—always fast-priming and non-leaking—even when the water is filled with sand, silt or dirt. Mechanical seals have wearing surfaces made of tungsten-carbide—almost diamond-hard—and consequently are practically immune to wear. Impeller and suction head are also made of wear-resisting material to provide long life and efficient performance. Simple design and few working parts assure lower operating and maintenance costs. Carver self-priming centrifugal pumps are available in a wide range of capacities from 3,000 to 200,000 g. p. h. with gasoline, Diesel or electric power. Dealers in all principal cities.



Cutaway section shows the scientifically correct design of Carver self-priming centrifugal pumps.

CARVER PUMP COMPANY
Muscatine, Iowa

CARVER CENTRIFUGAL Certified PUMPS



The little line that's all there

When a line is ruled on Arkwright Tracing Cloth, the ink flows like molten lead, and "freezes". It's all there. Make a mile of lines and you'll never strike a place where the cloth refuses to take ink.

This feature of Arkwright Cloths saves time, and time means money.

Arkwright's transparency saves time, too. A draftsman can *see,* easily and accurately. It is permanent, because transparency is achieved by mechanical processing, not by the use of surface oils. It doesn't become opaque with age.

Arkwright's freedom from imperfections saves time, money, and bad tempers. There are no nibs to trip a pen; no dirt, no stains. There are no pin holes, first or last. Repeated erasure never results in a feathered line.

Executives, purchasing agents, and draftsmen; all are interested in saving time, money, or both. To them samples are sent gladly. Write to Arkwright Finishing Company, Providence, R. I.

★

Sold by leading drawing material dealers everywhere

★

Arkwright

TRACING CLOTHS

AMERICA'S STANDARD FOR OVER 20 YEARS

of drill rod or wooden pole. Because of its small size, it can easily be carried in the driller's pocket until necessity for its use arises.—*Dings Magnetic Separator Co., 509 East Smith St., Milwaukee 7, Wis.*

• • •

Masonry Cutting Blade

Many tests were made of the Champion "Jade" abrasive masonary cutting blade before it was put on the market. According to the manufacturer it has proved to

have long life, low cost per cut and speed in cutting, in addition to elimination of operator eye-strain due to the safety jade color.

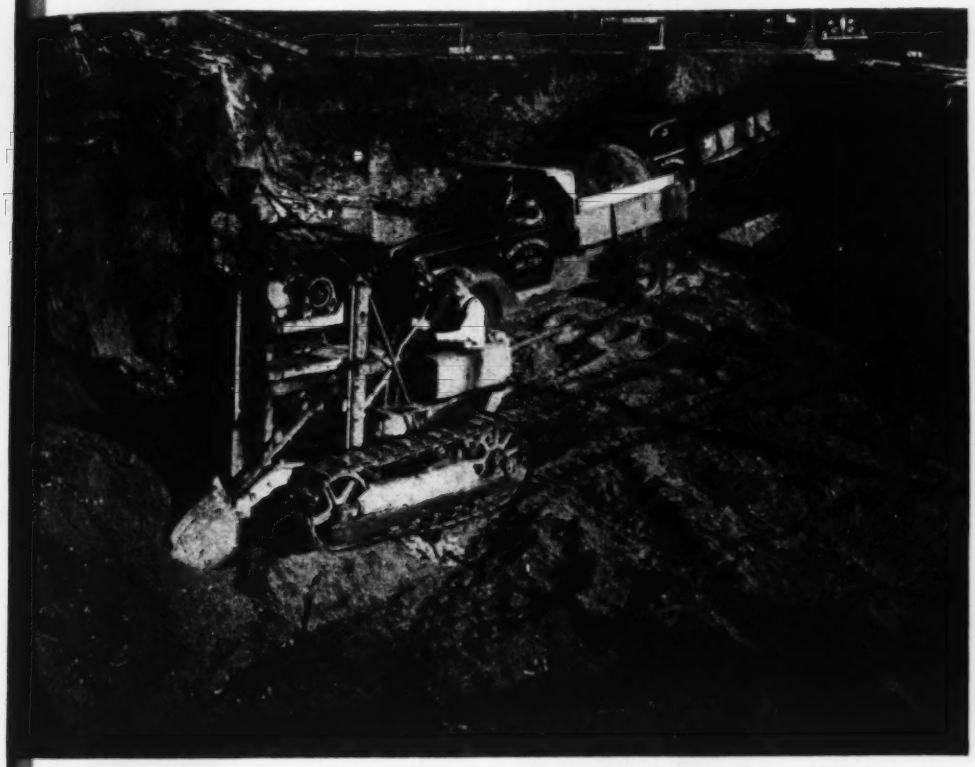
This blade, in 12 or 14-in. size to fit any type masonary cutting saw, is equipped with a blotter for safety in operation and a steel center which protects the machine shaft.—*The Champion Mfg. Co., 1307 Washington Ave., St. Louis, Mo.*

• • •

Light Excavator

Because it weighs not more than 8¾ tons complete, the ⅜ yd. "Junior" excavator, with partial swing operating advantages, is unusually portable and mobile. A 37.5 hp. industrial type motor can force the dipper through hard digging, and direct flow of power through large, wide-faced machine cut gears is

MORE WORK IN LESS TIME AT LOWER COST



Speaking of this D4-Traxcavator unit, Chet M. Herringer says: "Best excavating combination ever put together. We can dig an absolutely straight-walled excavation. And for backfilling it is unexcelled."

A "Caterpillar" Diesel D4 Tractor with 1-yd. Traxcavator is quick on its feet—loads trucks in fast time.

Every day more contractors are discovering the efficiency of "Caterpillar" Diesel Tractors with Traxcavators. They're powerful—fast-handling—economical. Built to take the toughest jobs you can give them and stay in there slugging.

Chet M. Herringer Co., Minneapolis, reports this record, made by a one-yard D4-Traxcavator unit, excavating the basement for a big garage:

Earth dug and loaded on trucks—2600 yards.

Time—36 working hours.

Fuel cost—$4.51.

This is just another case—among hundreds—that proves "Caterpillar" Diesel equipment does *more work in less time at lower cost.*

CATERPILLAR TRACTOR CO. • PEORIA, ILLINOIS

CATERPILLAR DIESEL

ENGINES • TRACTORS • MOTOR GRADERS • EARTHMOVING EQUIPMENT

MR. CONTRACTOR

It is your responsibility to control the air content of the concrete.

Read the new "specs" on the amount of air that must be entrained, and then use Darex AEA as a gauge-water addition. You can meet the specifications and keep the control of the air content in your hands. It's the only way you can compensate for changes occurring in the field.

Darex AEA costs only a few cents per yard. It is safe, harmless. Comes ready to use. Darex Air Entraining Concretes save you time and labor because they are plastic, workable, reduce segregation and bleeding, speed up finishing, give durable concrete. — DEWEY AND ALMY CHEMICAL COMPANY, Cambridge 40, Massachusetts.

Use Darex AEA with Confidence

Measuring meters available

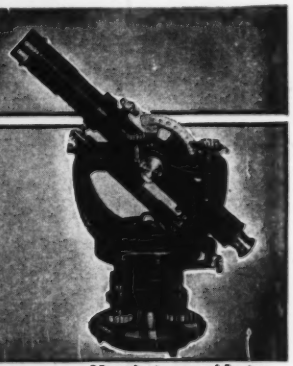
Simple metering devices for Darex AEA are available. Write for details.

Order Now!

UNIVERSAL
LEVEL-TRANSIT

Latest, improved model. Telescope 12" long, 25 power — Horizontal Circle 4½" with vernier to 5 minutes — Vertical Arc 5"

Instant change-over from Level to Transit. Most practical all-around builders' instrument ever designed. Write for full details.



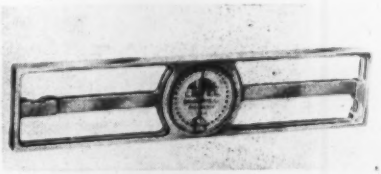
DAVID WHITE CO. 305 WEST COURT ST. MILWAUKEE 12, WIS.

Manufacturers of Instruments for Engineers, Surveyors and Builders.

said to transmit maximum horsepower to each operation.

Excavator operator and all working machinery are located on the non-weaving 14 in. main frame and do not swing with the boom. Gears, clutches, drums and shafting, low on the main frame, increase resistance against tipping on sloping ground.—*The Byers Machine Co., Ravenna, Ohio.*

• • •



Aluminum Spirit Level

Rustproof and weighing less than one pound, an all-aluminum spirit level with dial indicator in the center may be used in any position. Known as the All-Angle Level, this tool measures 14⅝ x 3 x ¾ in.

The dial indicator, guaranteed accurate to within one-half degree, is calibrated through a 360-deg. range. Two air bubble tubes have been built in, one for horizontal use and one for plumb testing.—*Brand Tool Co., 1513 East Colorado Blvd., Pasadena, Calif.*

• • •

Mobile Crane Unit

A rubber-mounted, mobile crane unit, embodying power shovel, truck hoe, dragline, and clamshell, is used for trenching, basement excavations, drainage, ditching and cleaning, and for handling sand and gravel. The operation of boom, shovel, trench hoe, or propulsion mechanism can be independent or simultaneous. The chassis is self-leveling, permitting operation on uneven ground. There is a full-vision cab.—*American Steel Dredge Co. Inc., Fort Wayne, Ind.*

• • •

Safety Treads

To forestall accidents on stairs and ramps, two treads have been developed to meet varying service requirements. Wooster abrasive cast treads are made in four cast metals—iron (Ferrogrit); aluminum (Alumogrit); bronze (Bronzogrit); nickel (Nicklogrit)—in plain, cross-hatch or fluted patterns. Wooster safe groove treads are of steel, yellow brass or white alloy, with lead or abrasive grit fillers.

A special formula impregnates grits in the surface of the tread and extends the cross-hatching to the edge. Both types may be readily applied to wornout stairs, floors, etc., as well as in new buildings, on wood, concrete, steel or sheet pan bases.—*Wooster Products, Inc., Wooster, Ohio.*

Reports and Pamphlets

(*Continued from page* 128)

PLANNING—A CHALLENGE TO PUBLIC WORKS ENGINEERS—Bulletin No. 29. American Public Works Association, Chicago 37, Ill. 75c.

TREATMENT OF ICY PAVEMENT—Committee Report-Bulletin No. 97. American Road Builders' Association, 1319 F Street Northwest, Washington 4, D. C.

PAVIMENTAZIONI PER AEROPORTI—Francesco M. Macchi. Industrie Grafiche Italiane Stucchi, Via Marcona, 50, Milano, Italy.

THE PUBLIC UTILITY FRANCHISE: ITS FUNCTIONS AND TERMS UNDER STATE REGULATION—John Bauer. Public Administration Service, Chicago 37, Ill. $1.00.

ELEMENTS OF A CITY PLAN FOR SARNIA—Norman D. Wilson. Advisory City Planning Commission, Sarnia, Ont.

DEPRECIATION POLICY AND POSTWAR EXPANSION—Lewis H. Kimmel. The Brookings Institution, Washington 6, D. C. 50c.

INDEX TO A.S.T.M. STANDARDS—December 1945. American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

1945 LAWS BULLETIN—No. 3. A Digest of New Legislation Affecting Highway Users. National Highway Users Conference, National Press Building, Washington, D. C.

AIR POLLUTION IN NEW YORK CITY—A Reprint from *Heating, Piping & Air Conditioning*, July, 1945. Department of Health, City of New York.

IMPROVEMENT AND DEVELOPMENT PROGRAM FOR THE CITY OF OMAHA—Mayor's Citywide Planning Committee, Omaha, Neb.

PILE FOUNDATIONS AND PILE STRUCTURES—Manual No. 27. American Society of Civil Engineers. 33 West 39th St., New York 18, N. Y. $1.10.

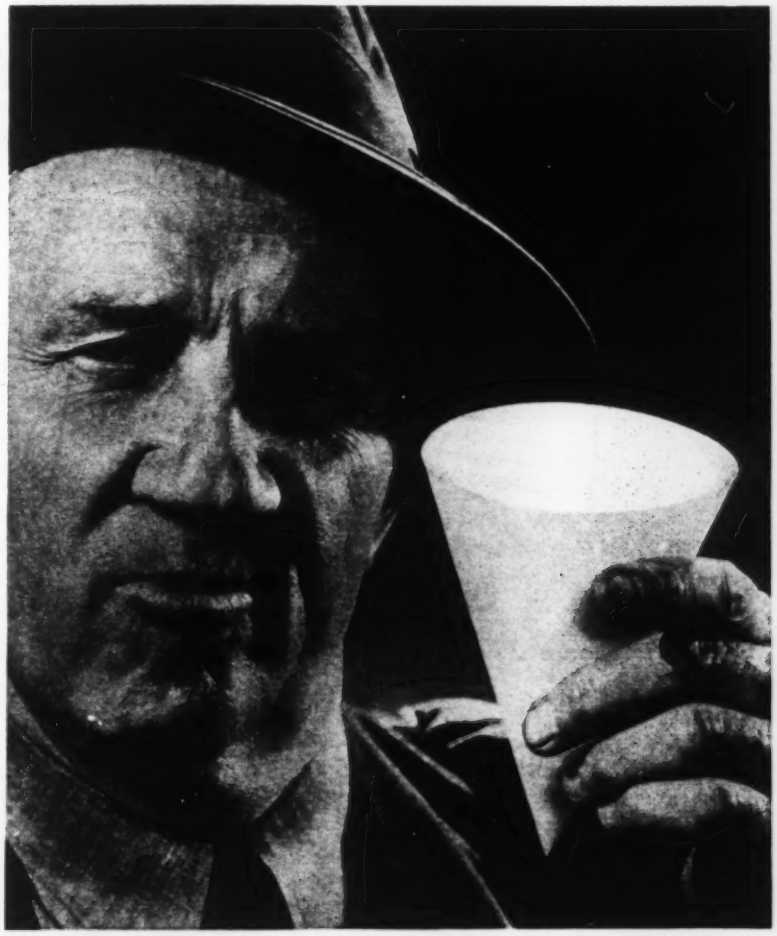
ROADSIDE DEVELOPMENT AND HIGHWAY WAR MEMORIALS—State Highway and Public Works Commission, Raleigh, N. C.

RECREATIONAL DEVELOPMENT OF ROOSEVELT LAKE—Columbia Basin Joint Investigations. U. S. Bureau of Reclamation. Superintendent of Documents, Washington 25, D. C. 75c.

INDUSTRIAL FIRE BRIGADES TRAINING MANUAL—National Fire Protection Assoc., 60 Batterymarch Street, Boston 10, Mass. $1.50.

OHIO'S WATER RESOURCES—By C. V. Youngquist. Engineering Experiment Station Circular $48. Ohio State University, Columbus, Ohio.

GROUND WATERS IN THE HIGH PLAINS OF TEXAS—(U.S.G.S. Water Supply Paper 889-F), 25c.; WATER LEVELS AND ARTESIAN PRESSURE IN OBSERVATION WELLS—Part 5, Northwestern States (Paper 990), 45c.; and Part 6, Southwestern States and Hawaii (Paper 991), 50c. Obtainable from the Superintendent of Documents, Washington 25, D. C. at prices indicated.



"we solved the water problem ...with portable tanks and VORTEX CUPS"

Every trip for water cuts down a man's working time —and encourages "gab-fests". Dixie's Portable Water Carrier plugs this time-waste. More important, it brings cool, clean water in individual Dixie or Vortex Cups—protectors against mouth-carried infections. Let it help you keep men well and working. *Write for descriptive folder.*

DIXIE'S PORTABLE WATER CARRIER

EFFICIENCY HINT: The more nearly water intake offsets sweat loss by men doing manual labor, the better their performance, as shown in report by Harvard University Fatigue Laboratory. Free copy on request.

DIXIE CUPS, VORTEX CUPS AND PAC-KUP CONTAINERS ARE MADE AT EASTON, PA., CHICAGO, ILL., DARLINGTON, S. C., TORONTO, CANADA

In heavy-duty hauling the trend is to "balanced trucks." Most fleet owners specify their own "balance" . . . the combination of chassis, engine, transmission and other assemblies which does their particular job best—at lowest cost. Because of the efficient performance, quiet running and long wear-life of Fuller Transmissions, more and more leading operators are specifying Fuller for their "balanced trucks." Why not take a tip from these profit-wise operators who say: "Specify Fuller. It pays!"

FULLER MANUFACTURING COMPANY, TRANSMISSION DIVISION
KALAMAZOO 13F, MICHIGAN
Unit Drop Forge Division, Milwaukee 1, Wisconsin

GRATE Economy!

Increase Boiler Ratings at a Savings

with MARION MASTER GRATES

• With efficient grates, coal waste is eliminated, boiler efficiency increased. MARION MASTER GRATES show immediate savings in fuel costs and send boiler ratings up. Clean fires assured with all grades of coal.

Experienced workmanship and superior materials give strength and durability to MARION MASTER GRATES.

HERE IS TRUE GRATE ECONOMY! WRITE FOR BULLETIN G-45.

Grates to Suit All Conditions.

MARION MACHINE, FOUNDRY & SUPPLY CO.
Marion, Indiana, U. S. A.

Men and Jobs

Charles H. Fullerton, surveyor general of Ontario, has retired at 71. A civil engineer graduate from the old School of Practical Science of the University of Toronto, Mr. Fullerton was associated with many important early engineering works in the province and was responsible for many works in the opening up of northern Ontario. He is succeeded by **F. Weldon Beatty,** who has been for some years in private practice in Pembroke, Ont., where he has been mayor for three years.

Joseph J. Bevacqua, civil engineering graduate of Cornell University, and pioneer in suburban planning at Rochester, N. Y., has been appointed the first director of the Monroe County Planning Commission.

Frank A. Batstone has been appointed planning engineer at Providence, R. I. He is a graduate of Massachusetts State College, 1934, and has been with various planning boards and most recently with the Baker Engineers, city planning and engineering organization of Rochester, N. Y.

M. L. A. Lyons, deputy minister of public works, Manitoba, has retired. A native of Nova Scotia and a graduate of the Massachusetts Institute of Technology, Mr. Lyons entered the government service in 1912.

Hall Reherd has resigned as city engineer at Anchorage, Alaska, to go into private business.

Roy Green, formerly works department engineer with the city planning commission at Tacoma, Wash., has been appointed assistant city engineer. He succeeds **George A. Mason,** who has gone with the Asphalt Paving & Engineering Co.

Three engineers with the Washington State Highway Department recently were presented awards for 25 years of service with the department. They are **George H. Shearer,** Seattle District engineer; **R. H. Kenyon,** state plans and contracts engineer, and **Earl C. Simpson,** work-control engineer.

Louis E. Robbe has retired as division engineer of the N. Y. City Board of Transportation, thus completing 40 years of civil engineering, interrupted by service in both wars. He is a graduate of Massachusetts Institute of Technology and started on construction work for the Pennsylvania R.R. tunnels under the Hudson

River, and later was on construction of the Ashokan and Gilboa dams for various tunnel jobs for the Board of Transportation.

After nearly 36 years in government services, **Commander Walter G. Will,** USCG, is retiring from the United States Coast Guard. He entered the Coast and Geodetic Survey in 1910 and transferred to the Lighthouse Service in 1912. In 1935, he was appointed superintendent of lighthouses at St. Louis, Mo. He went to Cleveland in 1940, being first assigned to the Northern Inspector's Office. In 1942, he was transferred to the Cleveland district office as civil engineering officer, having charge of construction and maintenance of all fixed structures such as lighthouses, lifeboat stations and depots.

L. L. Fittro, former senior public health engineer with the U. S. Public Health Service, has been appointed sanitation engineer with the Orange-Person-Chatham County Public Health District, with headquarters at Chapel Hill, N. C. A graduate of Virginia Polytechnic Institute with a degree in civil engineering and a major in sanitary engineering, he did postgraduate work at Harvard University and for three years was connected with the West Virginia Health Department. Since 1940 he has served with the U. S. Public Health Service, having served overseas for two years with UNRRA and for the last several months was assigned to the State of North Carolina Surplus Property Division. He was released from active duty on April 25.

Charles A. Battershill of Chicago, Ill., has been appointed city engineer of Vancouver, B.C., succeeding **Charles Brackenridge,** retired.

O. W. Wirth, Oakland civil engineer, has been appointed city engineer and superintendent of public utilities at Tracy City, Calif. He will supervise street, water and sewer departments.

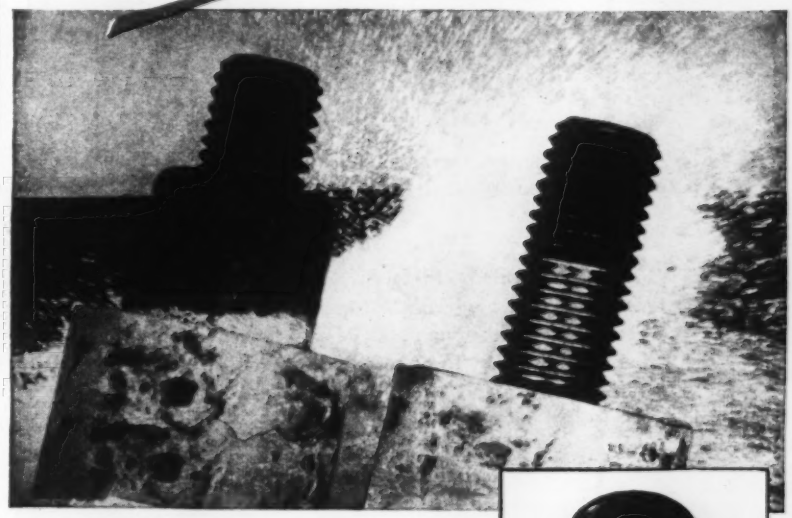
James V. Dillabough, formerly assistant district engineer of the Canadian National Railway at Edmonton, Alta., and later transportation engineer for the system, has retired after 41 years service.

Walter M. Maitland has been appointed city planning engineer for Bakersfield, Calif.

Benjamin Chappell, of Winnipeg, Man., has been appointed engineer, Western Region, Canadian National Raceways, succeeding **E. N. Johnson,** retired.

Ralph Speer has been engaged as city engineer and water superintendent at Iron Mountain, Mich., succeeding **H. T.**

SELF-SEALING TO *Prevent Corrosion* OF BOLT THREADS



—with the Red Elastic Collar that protects the threads against Liquid Seepage

Moisture cannot penetrate the Red Elastic Collar. Study the heavily corroded bolt and nut assembly in the unretouched test photograph. It has been subjected to the equivalent of three years' exposure to moisture . . . to industrial smoke and grime . . . to climatic change. Study the same bolt with the nut removed. Look at the bolt threads that were inside the Elastic Stop Nut. They're as good as new! Why? Because the Red Elastic Collar protects them permanently against Liquid Seepage—and Corrosion.

Elastic Stop Nuts are easily removed because they cannot 'rust solid'. They prevent fasteners from failing because of corrosion weakened threads.

Here's a challenge: Send us complete details of your toughest bolted trouble spot. We'll supply test nuts—FREE, in experimental quantities. For further information or literature address: Elastic Stop Nut Corporation of America, Union, New Jersey. Agents and Representatives located in principal cities.

The RED ELASTIC COLLAR

—denoting an ESNA product—

. . . is threadless and permanently elastic. Every bolt—*regardless of commercial tolerances*—impresses (does not cut) its full thread contact in the Red Elastic Collar. This threading action produces a compressive, radial-reactive pressure against *both* the top and bottom sides of the bolt threads . . . insures a permanently tight, full contact between the bolt and nut threads . . . and makes all Elastic Stop Nuts self-sealing against Liquid Seepage.

As a result, all Elastic Stop Nuts protect permanently against thread corrosion.

ESNA

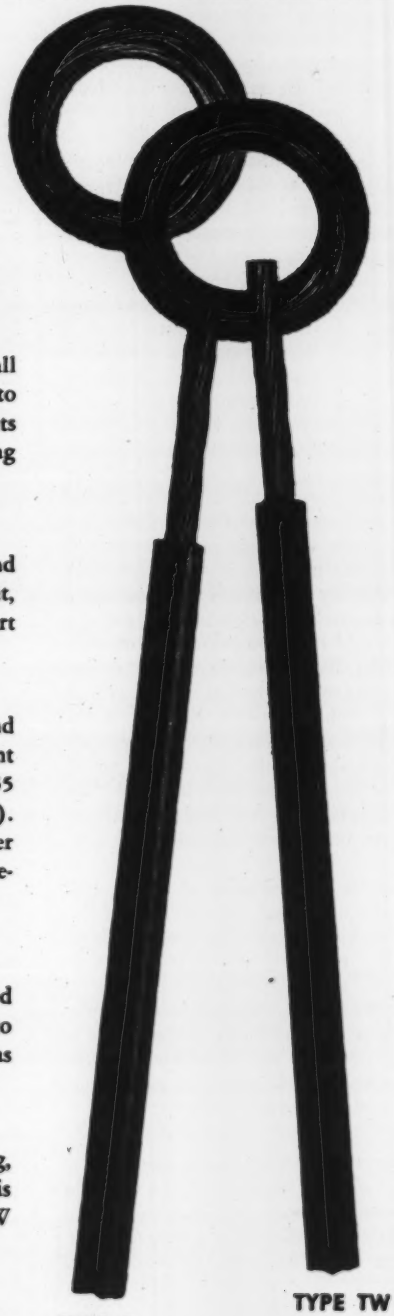
ELASTIC STOP NUTS

INTERNAL WRENCHING · ANCHOR · INSTRUMENT MOUNTING · SPLINE · CLINCH · GANG CHANNEL

***PRODUCTS OF:* ELASTIC STOP NUT CORPORATION OF AMERICA**

G-E data sheet for construction engineers

G-E Thermoplastic BUILDING WIRE



TYPE T TYPE TW

Description

G-E thermoplastic building wire (Types T and TW) is a small diameter wire made of highest quality materials and produced to meet rigid specifications. It can be used for all wiring requirements where permitted by local codes and is suited for widely varying service conditions.

Physical Properties

G-E thermoplastic building wire resists oils, acids, alkalies and other chemicals and solvents. It is virtually unaffected by sunlight, moisture and weathering. It resists flame and will not support combustion.

Electrical

G-E thermoplastic building wire is high in dielectric strength and will withstand a 720-volt per mil breakdown voltage. Current carrying capacity ranges from 18 amperes for size 14, to 455 amperes for 1000000 CM (based on National Electric Code). High insulation resistance eliminates the danger of loss of power due to current leakage. Types T and TW wires may be used wherever Types R, RL, and RW are acceptable.

Insulation

G-E thermoplastic building wire is insulated with plasticized polyvinyl chloride compounds which give it unusual resistance to aging, abrasion, and extremes of temperature. The insulation has a hard, smooth finish.

Types

Types T and TW building wires are suitable for new wiring, rewiring, maintenance wiring, and special wiring. Type T is recommended where general-purpose wiring is suitable. Type TW is recommended for service in permanently wet locations.

Information

Ask your nearest G-E Merchandise Distributor or write to Section W664-113, for additional data on physical and chemical characteristics, sizes, typical applications, etc. General Electric Company, Appliance and Merchandise Department, Bridgeport, Connecticut.

GENERAL ELECTRIC

THROUGH FOUR SEVERE WINTERS... "NO DETERIORATION OR CRACKS"*

COLUMBIA RIVER JETTY TERMINAL *built with* POZZOLITH CONCRETE

Excerpt from article, Pacific Builder and Engineer, April 1944 —

"The grading of aggregates and the mix were in accordance with standard government specifications, and provided for at least 4½ sacks of cement (Fed. Spec. SS-C-206) per cu. yd. The contractor was allowed to use an admixture of Pozzolith, at his own expense, to provide greater workability, as the long journey over the rough railroad track otherwise made it difficult to dump the concrete on arrival at the work."

Exposed to salt water corrosion and wave action, in addition to freezing and thawing, through four severe winters, this Pozzolith Concrete jetty terminal at the mouth of the Columbia River shows no deterioration or cracks.

Here is an excellent example of the great durability of Pozzolith Concrete even under extremely severe conditions.

Pozzolith produces all the benefits of air entrainment and does so with increased strength and at lower cost. Findings of the Nation's top testing authority prove this. Pozzolith's high standard of performance has won it wide acceptance as use in millions of cubic yards of concrete testify.

Write for complete information on the advantages of cement dispersion, and Pozzolith folder . . . today.

THE MASTER BUILDERS COMPANY
CLEVELAND 3, OHIO · TORONTO, ONTARIO

MASTER BUILDERS

Black on White for Better Sight

WYTEFACE "A" Steel Tapes have *raised* black graduations on a crack-proof white surface. Easy to read in any light, from any angle. Faster measurements with fewer errors. Designed for hard service. White background is protected by raised steel markings and rims. Resists abrasion from rails, pipe, rocks, concrete. Protected against rust. See your dealer. Write for catalog.

K+E

Drafting Reproductions Surveying Equipment and Materials Slide Rules Measuring Tapes

KEUFFEL & ESSER CO.
EST. 1867
NEW YORK • HOBOKEN, N. J.
CHICAGO • DETROIT • ST. LOUIS
SAN FRANCISCO • LOS ANGELES • MONTREAL

WYTEFACE "A"
STEEL MEASURING TAPES

McNeely, resigned. He had been city engineer for 20 years at Sault Ste Marie.

A. J. S. Taunton has been named deputy engineer and deputy commissioner of buildings, Winnipeg, Man.

Maj. Edgar L. Grider, West Coast construction engineer, is now in Korea with Military Government forces as executive officer of the 40th Military Government Co., with headquarters in Seoul. Entering the Army in June, 1943, Maj. Grider attended the Engineer School before he was assigned to the 1320th Engineers at Camp Swift. He went to Hawaii in February, 1944, and served part time as district engineer on the island of Maui. He returned in December, 1944, to attend the School of Military Government, University of Virginia, and the Civil Affairs Training School, University of Chicago. He left for Korea in October 1945.

John E. Kitchen, senior engineer and head of the Sacramento district sub-office at Salt Lake City, Utah, has resigned after 18 years with the Army Corps of Engineers to enter private business in Reno, Nev. Mr. Kitchen supervised construction of the Sierra Ordnance Depot in Larsen County, Calif. and the wartime expansion of Mather Field.

Winston N. Marshall has been named engineer for the Tennessee Railroad and Public Utilities Commission at Nashville.

Roy A. Williams, formerly executive assistant, has become city engineer of Miami, Fla., succeeding C. S. Nichols who died recently.

Martin J. Teigen, recently temporary county engineer of Hughes County, S. D., has resigned to go into private business.

Dean R. Rounds, for the past 15 years engineer of Pennington County, S. D., at Rapid City, has resigned to operate his own construction company.

Frank E. Cave, formerly assistant and acting bridge engineer of the North Dakota Highway Department and with the department since 1925, has been named chief bridge engineer, succeeding **Clifford Johnson,** who resigned to enter private practice in Denver, Colo.

George Cross, county engineer for Roberts County at Sisseton, S. D., has resigned and has been succeeded by **Joe Plut, Jr.**

Warren K. Myers, district engineer at Indiana, Pa., has been promoted to assistant chief engineer in charge of maintenance of the Pennsylvania Department of Highways. **L. J. Curran** succeeds him at Indiana.

Adams
DISTRIBUTORS
Headquarters for
MACHINERY and SERVICE

ALA.... Montgomery—Ray-Brooks Machinery Company
Birmingham—Tractor & Equipment Company
ALASK.. Fairbanks—Glenn Carrington & Company
ARIZ.... Phoenix—O. S. Stapley Company
ARK.... Little Rock—Little Rock Road Machinery Co.
CALIF... Western Factory Branch
J. D. ADAMS MANUFACTURING CO.
230 7th Street, San Francisco 3
Adams Distributors at: San Francisco, Los Angeles, Sacramento, Redding, Riverside, San Jose, Fresno, Stockton, Salinas, Santa Rosa, Modesto, Visalia, Merced, Bakersfield, Santa Maria and San Diego
COLO... Denver—McKelvy Machinery Company
CONN... New Haven—W. I. Clark Company
DEL.... Phillips Machinery & Tractor Co., Baltimore
FLA..... Jacksonville, Miami, Tampa—Florida Equipment Co.
Pensacola—Ray-Brooks Truck & Tractor Company
GA..... Atlanta—Tri-State, Inc.
Albany—Tri-State Tractor Company
IDA..... Boise & Pocatello—Intermountain Equipment Co.
ILL..... Peoria & Springfield—A. E. Hudson Company
Salem—E. W. Werner Motor Company
Chicago—R. C. Larkin Co.
IND..... Indianapolis—Indiana Equipment Co., Inc.
IOWA... Des Moines—Herman M. Brown Company
KANS... Wichita—S. H. Denney Road Machinery Co.
KY..... Louisville—Brandeis Machinery & Supply Co.
LA..... Baton Rouge & Monroe—Dunham-Pugh Co.
MAINE. Portland—Maine Truck-Tractor Co.
MD..... Baltimore—Phillips Machinery & Tractor Co.
MASS... Newton Upper Falls—United Equip. Corp.
MICH... Bark River—Bark River Culvert & Equipment Co.
Detroit and Grand Rapids—
Wolverine Tractor & Equipment Co.
MINN... Minneapolis & Duluth—Roshot Equipment Co.
MISS... Jackson—Mississippi Road Supply Co.
MO..... St. Louis—Missouri-Illinois Tractor & Equip. Co.
Kansas City—Noel V. Wood, Inc.
MONT.. Billings & Missoula—Industrial Equipment Co.
NEB.... Omaha—Nebraska Tractor & Equipment Company
North Platte—Cornhusker Tractor & Equip. Co.
NEV.... Reno—Brown Motors
N. H.... Manchester—R. C. Hazelton Co.
N. J..... Trenton—Ross, Young, Dilts Company
N. M.... Albuquerque—Hardin & Coggins
N. Y..... Buffalo—Dow & Company, Inc.
Brooklyn—Edward Ehrbar, Inc.
Long Island—George Malvese & Co.
Albany, Syracuse—Milton-Hale Mach. Co.
N. C.... Raleigh—J. B. Hunt & Sons
N. D.... Fargo—Myhra Equipment Company
OHIO... Cleveland—Gibson-Stewart Company
Cincinnati—Rish Equipment Co.
Cambridge—Major Equipment Co.
Marion—Hamilton Equipment Co.
OKLA... Tulsa & Guthrie—C. L. Boyd Company, Inc.
ORE..... Portland & Eugene—Howard-Cooper Corporation
PA..... Butler—National Equipment Co.
Pittsburgh—Atlas Equipment Corp.
Philadelphia—Service Supply Corp.
Harrisburg & Wilkes-Barre (Kingston)—
State Equipment Co.
R. I..... Providence—Tractors, Inc.
S. C..... Columbia—N. H. Summers Road Machinery Co.
S. D..... Sioux Falls, Rapid City—Empire Equipment Company
TENN... Knoxville & Chattanooga—Brooks Equip. & Mfg. Co.
Nashville—Industrial Tractor & Equipment Co., Inc.
Memphis—Road Builders Equipment Co.
TEXAS. Dallas & Houston—Browning-Ferris Machinery Co.
San Antonio—Jess McNeel Machinery Co.
Plainview & Sweetwater—Plains Mach. Co.
El Paso—Hardin and Coggins
UTAH.. Salt Lake City—The Lang Company
VA..... Richmond—Municipal Sales Company
Richmond and Roanoke—Rish Equipment Co.
Alexandria—Phillips Mach. & Tractor Co.
WASH.. Seattle—Howard-Cooper Corp.
Spokane—Intermountain Equip. Co.
W. VA... Charleston and Clarksburg—Rish Equipment Co.
WIS..... Eau Claire—Bark River Culvert & Equipment Co.

SEE **Adams** AD ON OPPOSITE PAGE

About District Engineers

Col. Charles H. McNutt has been appointed deputy district engineer for the U. S. Engineer District, Sacramento, Calif., where he will assist in the expanding Army civil works program throughout central California, Nevada, Utah, and parts of Oregon.

Immediately prior to this appointment Colonel McNutt had been engaged in wind-up supply problems of the southwest Pacific in Washington, D. C., and previous to that had completed 44 months of overseas duty where he was in command of an Engineer battalion, ending as service commander for the city of Manila.

A C. E. graduate of the University of California in 1927, McNutt before the war had been connected with Mississippi River flood control developments. At his new post he will work with Col. Lester F. Rhodes, Sacramento district engineer.

Col. Edwin H. Marks has assumed duty as division engineer of the recently created South Pacific Division of the U. S. Corps of Engineers. He succeeded Brig. Gen. Philip G. Bruton, who has been retired. **Col. Geo. Mayo,** district engineer of the San Francisco district has been acting division engineer during the interim. Colonel Marks, who is a West Point graduate, 1909, goes to San Francisco from Dallas, Tex., where, for the last two years, he has been commanding general of the Southwestern division with the wartime rank of brigadier general. He has had a wide experience in engineering work throughout the U. S., in Panama, and in the Philippines. During the war he was assigned to command the engineering training center at Ft. Belvoir, Va., and was placed in general charge of all activities there. He has been awarded the Distinguished Service Medal.

Col. Roy D. Burdick, United States district engineer, Little Rock, Ark., has announced that he is going to retire after 30 years of army service and will become associated with a private firm as a consulting engineer at West Palm Beach, Fla. Colonel Burdick, who was stationed at Little Rock for 15 months, was former deputy division engineer at St. Louis. He directed the fight against Arkansas floods last year and was instrumental in speeding up construction of military posts.

ESCO 2¼ yard Cast-Welded Dipper Bucket on Lorain 82, loading rock at Kanawha Airport. Note how ESCO dogleg bail cradles large rocks.

TURNING a mountain top into a modern airport is a tough job which requires tough equipment.

The Kanawha Airport at Charleston, West Virginia, was built in this way by the Harrison Construction Company of Pittsburgh, Pa. . . . and a vital part of their excavating equipment was *ESCO Manganese Steel* Dipper Buckets. These were used to help load more than 3½ million yards of blasted rock.

On tough jobs from coast to to coast, the *ESCO* buckets do their work without pampering, increase profits in three ways—

1. **DIG FASTER.** Clean cutting front with integral tooth bases and flaring outside teeth give clean, full bite. Tapered box permits quick, complete load discharge.
2. **CARRY GREATER PAYLOADS.** Hollow arch construction and use of manganese shock-resistant steel reduces weight without sacrificing strength. Lighter weight means greater payloads.
3. **LAST LONGER.** Strain is distributed evenly throughout the bucket. Parts subject to wear and shock are made of manganese steel, grow harder and tougher the more they work.

ESCO makes two types of dipper buckets — the Cast-Welded for general purpose use and the All-Cast Manganese for extremely hard service. Complete information is contained in *ESCO* bulletins 156 and 114B. Get a copy of each from your nearest *ESCO* representative, or write us direct.

ELECTRIC STEEL FOUNDRY

2141 N. W. 25th Avenue • Portland 10, Oregon

SPECIALISTS IN APPLIED METALLURGY

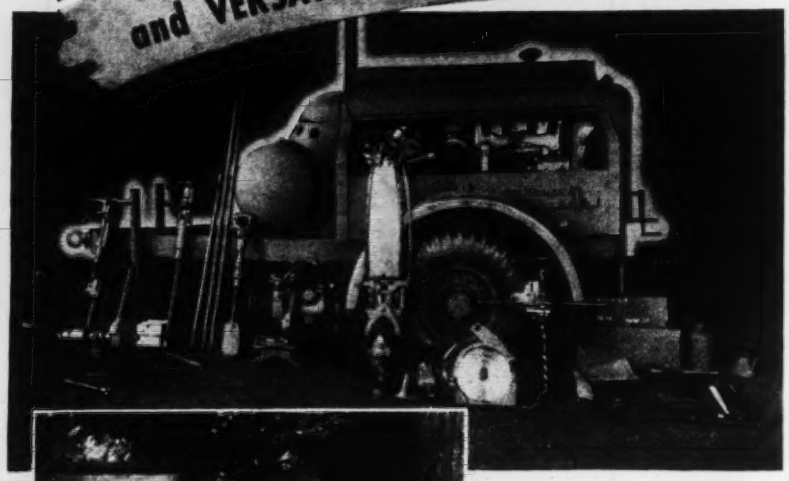
Offices and Warehouses

SEATTLE, 4 2724 First Ave. S. Elliott 4161	HONOLULU, 5 814 Kapiolani Blvd. Phone 6486	NEW YORK, 17 Graybar Building Lexington 28958	SAN FRANCISCO, 7 699 Second Street Douglas 8346
SPOKANE, 8 121 S. Monroe St. Main 5530	LOS ANGELES, 11 4600 Pacific Blvd. Lucas 7251	CHICAGO, 1 221 N. LaSalle St. Dearborn 2284	EUGENE, ORE. 1991 Sixth Ave., W. Phone 5012

IN CANADA— *esco* LIMITED, 1084 Homer St., Vancouver, B. C. Telephone Marine 2343

WAUKESHA-POWERED

AIR TOOLS for MOBILITY and VERSATILITY on all fronts...



Air tool used by Royal Canadian Engineers — a Waukesha Engine powered Canadian Ingersoll-Rand Portable Air Compressor, complete with auxiliary equipment including a chain saw for felling trees, power hand saw for heavy timber construction, air operated auger, grinding stand and sump pump.

●

Making repairs at battle front — Royal Canadian Engineers using an air hoist, mounted on a tree trunk, to pull a drag scraper. *Overseas Photo Courtesy of Dept. of National Defense (Canada)*

Compressed air was "ammunition" for the front-line Royal Canadian Engineers who repaired damaged bridges and constructed new ones, built roads, landing fields and advanced bases. *Waukesha-powered* Canadian Ingersoll-Rand Portable Air Compressors give their pneumatic tools the mobility and versatility so vital to battle-winning efficiency . . .

This Waukesha-powered equipment is now ready for peacetime work . . . building bridges and highways, tamping ties, municipal street maintenance, and all construction contractors' projects.

The Waukesha Engine and the compressor are joined in a single unified assembly—for complete reliability. All the advantages of multi-cylinder power—quicker acceleration, clean combustion, cool valves and fuel economy with more power—are built into this compact, sturdy, 4-cylinder Waukesha Engine.

Waukesha Engines . . . gas, gasoline, or diesel fuel. . . . for shovels, cranes, hoists, pavers, mixers, graders, surfacers, tractors or any peacetime industrial power machinery are available *now!* Consult Waukesha about all your engine needs.

Get Bulletin 1377

WAUKESHA MOTOR COMPANY, WAUKESHA, WIS.

NEW YORK • TULSA • LOS ANGELES

WAUKESHA ENGINES

Civilian Activity

Robert W. Carlson, in active service from 1941 to 1945 in Europe in command of the 188th Field Artillery Battalion, has opened a consulting engineering office in Bismarck, N. D.

R. M. Edgar, colonel, U. S. Army, has been named chief of construction in Ohio, Michigan and Kentucky for the Veterans Administration.

Roy L. Gardner, major, C.E., U. S. Army, has returned to the firm of Gardner, Gardner and Hitchings, Seattle, Wash.

W. K. Dickson, colonel, and **H. L. Stilwell,** lieutenant colonel, Corps of Engineers, have formed the engineering firm of Dickson and Stilwell at Charlotte, N. C. With them is **R. M. Allison,** captain, C.E., who was associated with Colonel Dickson in private practice before both entered the Army.

Karl Jacobsen, formerly head of Jacobsen-Jensen Co. and recently a captain serving with Army Air Force engineers in China, Burma and India, has returned to the contracting business as head of K. F. Jacobsen & Co., Portland, Ore.

James L. Neville, formerly a sanitary engineer with the Army Air Forces, has been named city engineer at Scottsbluff, Neb.

Darwin E. Hoppert, recently discharged from the Army, has been appointed sanitary engineer of the Southwest District Health Unit of North Dakota at New England, N. D.

Burt Livingston, after 31 months with the Signal Corps, has been named assistant to the city engineer of Newton, Iowa.

Edward Heinlein, released from the Navy as a lieutenant (j.g.) has joined the Illinois Division of Highways at Springfield as a civil engineer.

Robert Ryder, lieutenant (j.g.), C.E.C., USNR, is now with the St. Paul, Minn., district office of the Veterans Administration.

LaVern Temple, recently discharged from the Navy's Civil Engineering Corps, has been named city engineer for Dubuque, Iowa.

Paul J. McKay, former construction engineer for the Seattle district for the Washington State Highway Department, has been appointed construction engineer for the Vancouver district. Recently returned from a long period of overseas service with the Seabees, he takes the place of **Mathew P. Brislawn,** who has been appointed office engineer for the district.

Accuracy

LINKED closely to the precision jobs coming off the boards are the tools that assure accuracy of detail. One of these is the seemingly small pencil which looms large in the mind of a craftsman, as an important instrument of accuracy.

VENUS Drawing Pencils are engineered to give you drafting perfection without failure: accurately *graded* to assure uniformity in all 17 degrees . . . *strong* in performance . . . *smooth* and *clean* in action.

Put VENUS to the test on your drawing board. Send us a postcard or a note for two free samples. Specify degrees wanted.

VENUS *DRAWING PENCILS*

AMERICAN LEAD PENCIL COMPANY, HOBOKEN, NEW JERSEY

You can profit by our EXPERIENCE in building

ONLY with Briggs & Stratton 4-cycle engines can you profit by the skill and experience of an organization which has built 2½ Million air-cooled engines. *Their record of dependable performance* through the years is your assurance that "it's powered right when it's powered by Briggs & Stratton"—a factor of utmost importance to every user, dealer and manufacturer of gasoline powered appliances, farm machinery or industrial equipment.

BRIGGS & STRATTON CORPORATION • MILWAUKEE 1, WISCONSIN, U.S.A.

Air-Cooled Power

4 CYCLE
BRIGGS & STRATTON
GASOLINE ENGINES

(*Continued from page* 158)

Corradino Nicolazzo, colonel, who was with the Army Engineers, has been appointed chief of the building inspection department of Kenosha, Wis. He was graduated as a civil engineer at Denison University.

Wayne G. Bryan, recently discharged from the Navy, is city engineer of Neenah, Wis., succeeding **A. G. Prunuske,** who resigned to assume a similar position at Port Washington, Wis. Mr. Bryan was water superintendent of Portage. He also was formerly assistant water engineer at the Badger Ordnance Works for the Hercules Powder Co.

Chester H. Canham, lieutenant, newly released from the Army, has been named branch manager of the Indiana Health Department's sanitary engineering office at Terre Haute.

Thomas J. Fowler of St. Paul, Minn., who was associate division engineer of the Bureau of Community Facilities, and **Joseph Veranth,** of Ely, Minn. who was a lieutenant commander in the Seabees, both having been in charge of construction overseas, have formed a general contracting firm, the Fowler-Veranth Construction Co., at Duluth, Minn.

Edward G. Cantwell, colonel, and **William P. Turner,** captain, recently of the Corps of Engineers, have organized the Cantwell Machinery Co., at Columbus, Ohio. **L. A. Boulay** is general manager.

W. F. Arksey is back with the water service division of the Great Northern Railroad in Minneapolis, Minn., after serving with the 704 Railway Division in Africa and Italy.

C. F. Intlekofer, who served in the Pacific Area with the 128th Naval Construction Battalion, is with the bridge department of the Great Northern Railroad in Minneapolis, Minn.

C. D. Okerlund, who was with the 835 Aviation Engineers in Italy, is in the public works department, city engineer's office, St. Paul, Minn.

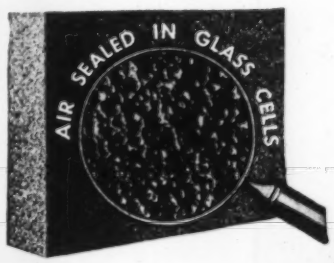
William H. Nelson, colonel, labor relations officer for the 8th Service Command in Dallas, Tex., will return soon as senior engineer Seattle, Wash.

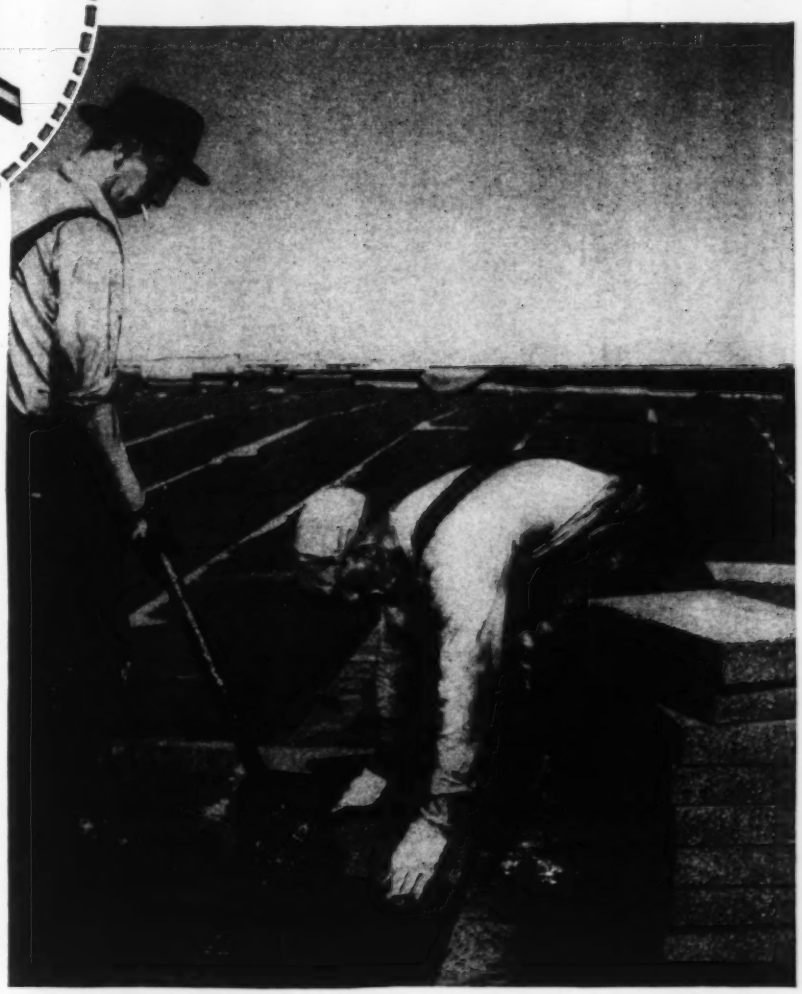
Harry J. Keefe has returned from the Navy to be chief field engineer and a director of Engineering Associates, Inc., of Boston, Mass.

The Carter Construction Co., Geneva, Ala., has resumed activity after the return of **J. P. Carter, Jr.,** from the armed forces. He had been assigned to the Jacksonville, Fla., office of the Corps of Engineers and in 1943 served on the staff of the Burma Road Engineers.

CHECK OTHER INSULATIONS AGAINST

PC FOAMGLAS INSULATION





PC Foamglas insulation solves the toughest insulating problems — *permanently.*

This cellular material is the only insulation composed of millions of tiny globules of air sealed in glass. It withstands attack by moisture, vapor and the fumes of most acids—elements which frequently impair or destroy the insulating value of other materials.

Rigid and strong, PC Foamglas will not swell, shrink, powder or rot. It repels vermin. It is waterproof, fireproof. It *stays* where insulation is required, will not slip, slide or pack down.

PC Foamglas needs no maintenance, repairs or replacements through the years. It helps to maintain temperature levels, to minimize condensation.

PC Foamglas has proved its ability to do a thorough job of insulation in floors, core walls, and roofs, in factories, hospitals, schools—buildings of every kind—all over the country.

· *Also makers of PC Glass Blocks* ·

FIND OUT what PC Foamglas has to offer *you.* Our illustrated booklets are packed with valuable engineering data, tables, charts, drawings and installation details. We shall be glad to send you the information you need free of charge—if you will just check the convenient coupon and mail it to Pittsburgh Corning Corporation, Room 164, 632 Duquesne Way, Pittsburgh 22, Pennsylvania.

Pittsburgh Corning Corporation
Room 164, 632 Duquesne Way
Pittsburgh 22, Pa.

Please send me without obligation, your free booklets on the use of PC Foamglas insulation for:

Roofs_____ Walls_____ Floors_____

Name_____

Address_____

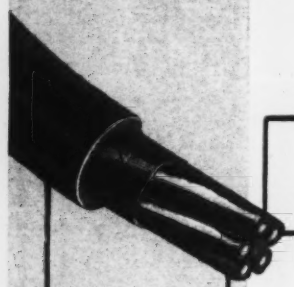
City_____ State_____

PC FOAMGLAS *Waterproof Fireproof* **INSULATION**

T M REG U S PAT OFF

Vital to Value today

Present-day costs of installation, present-day charges for repairs put a premium on *getting the best the first time.* So, in selecting a cable, it pays more than ever today to look for life-extending features built into the cable. Here is what Okolite-Okoprene* offers.



1 **Okoloy-coated copper conductors** made corrosion-resistant by an all-enveloping coat of a lead alloy developed through Okonite research nearly 20 years ago. Okoloy outlasts "tinning" 2 to 1.

2 **Long-lived Okolite insulation,** a moisture-resistant insulating compound proved in service to industry since 1930. Applied by Okonite's strip insulating process and vulcanized in a continuous metal mold, it is extremely stable in its electrical properties. Also widely used for circuits up to 35,000 volts.

3 **Protective covering of Okoprene,** a neoprene compound developed a dozen years ago by Okonite research to eliminate perishable braids and to seal the insulation from air and sunlight. It not only adds electrical strength but also resists oil, chemicals and ozone. Non-flammable, heat-resistant Okoprene is bonded to the insulation and, in single conductor cables, no other covering is needed.

4 **Tough and durable Okoprene sheath** for additional protection of multi-conductor cables installed underground or in exposed locations. Non-metallic Okoprene jackets resist mechanical injury and cannot be damaged by corrosion and electrolysis.

OKONITE insulated wires and cables

OKONITE SINCE 1878

*U. S. Pat. No. 2,313,058

Talk over your needs with an Okonite engineer. The Okonite Company, Passaic, New Jersey.

➡ ...and for shovel and dredge cables... OKOCORD (Bulletin OK 2011)

4622

The Butte County, Calif., board of supervisors has accepted the resignation of **Bert N. Paxton** as consulting engineer. Paxton will resume his private engineering practice.

Donald A. Cole, St. Cloud, Minn., has been named Red Lake County engineer with headquarters at Red Lake Falls. He succeeds **Bert J. Pinsonneault,** who resigned to be county engineer of Wabasha County.

Robert H. West, city engineer of Marshfield, Wis., has resigned.

H. C. Hansen, who has served Lake County, Minn., as county engineer for 31 years with headquarters at Two Harbors, is retiring.

James M. Carroll, who has been assistant city engineer at Great Falls, Mont., has been appointed city engineer for Glasgow, Mont.

Walter Murphy, civil engineer, Gaylord, Minn., who has been the Sibley County highway staff engineer for 18 months, has started practice as surveyor and engineer. His office will be at the county engineer's office. **Stanley Benson,** assistant highway engineer from Lac Qui Parle County, will replace Murphy on the county engineer staff.

Decorations were conferred on three Army Engineer officers May 7. **Col. Edward F. Kumpe,** received the Legion of Merit and a bronze oak leaf cluster; **Col. Carl M. Sciple,** a Legion of Merit; and **Col. Xenophon H. Price,** a Bronze Star. Colonel Kumpe was honored for his services as commanding officer 648th Engineer Base Topographic Battalion and later as theater mapping officer, General Headquarters, Southwest Pacific area.

Colonel Sciple was honored for his work with the Corps of Engineers, Army of the United States, as assistant chief and later chief. Price Adjustment Division, Office, Chief of Engineers.

On most jobs When Excavating is Necessary

You'll most likely come face to face with one or more Owen buckets, should your travels take you to an excavating job.

The reason why is most simple, for consistent superior bucket performance by Owens is responsible for their widespread use and acceptance.

Bring your equipment catalog files up to date NOW by requesting your copy of the latest Owen Catalog.

The OWEN BUCKET Co.
6010 Breakwater Avenue Cleveland, Ohio
Branches: New York Philadelphia Chicago Berkeley, Cal.

HOW MUCH CONSTRUCTION WILL BE PERMITTED?

The new building control orders will permit repairs and alterations on existing industrial buildings to the tune of millions of dollars.

On top of that, over a billion dollars' worth of *new plant construction* has been estimated for 1946! And this vast industrial building program is just one part of the overall schedule facing engineers and contractors today.

In all of this construction, concrete will be used, calling for enormous quantities of cement. And a large portion of the total will consist of the four Lehigh Cements:

LEHIGH NORMAL CEMENT, the time-proven cement for general construction work.

LEHIGH EARLY STRENGTH CEMENT, for a quicker job because it reaches service strength 3 to 5 times faster.

LEHIGH MORTAR CEMENT, for a mortar with strong binding qualities and minimum shrinkage . . . for all types of masonry and for stucco.

LEHIGH AIR-ENTRAINING CEMENT, for minimum scaling of exposed concrete surfaces by increasing resistance to the action of freezing and thawing and ice-removal salts.

The Lehigh Service Department will be glad to consult with you regarding the use of concrete on any of your projects.

Lehigh CEMENTS

LEHIGH PORTLAND CEMENT COMPANY • ALLENTOWN, PA. • CHICAGO, ILL. • SPOKANE, WASH.

Mr. Fillet Weld

FLOORS 'EM . . . BIG OR SMALL

Mr. Fillet Weld is a real champion when it comes to laying out open steel flooring in your plant. And, he measures up to all sizes, be they large or small areas.

***when you want a winner select* BATES • GRATES**

Fillet Welded **BATES • GRATES**, with the Hex Bar design, have these outstanding qualities:

- **Longer lasting**—Fillet Welding of the Hex Bars to the main bars produces a grating which exceeds all former strength standards.
- **Safer**—the Hex Bar, Fillet Welded to the main bar, provides a clean, crisp surface for sure footing.
- **Better light and ventilation**—the Hex Bar, Fillet Welded **BATES • GRATES** design allows more light and air to come through.

for stair treads, open steel flooring, floor armor and bridge decking . . .
Get a Bid from BATES

December, 1942, to February, 1945, Colonel Price performed meritorious service as Engineer member of the War Department Observers' Board in the European Theater of Operations during the period from July to October, 1944.

Joseph P. Collopy, formerly project engineer of the Department of Agriculture's Soil Conservation Service at Hay Springs, Nebr. has been appointed superintendent of operation and maintenance for the Bureau of Reclamation Gila project near Yuma, Ariz.

In charge of the new Illinois District office of the Public Roads Administration at Springfield, Ill. is **F. M. Johnson,** a veteran of 27 years with the PRA. Assisting him are **Edwin Fries, Norman Gundrum, Thomas Beppard, Randolph Martin, I. J. Ulak, L. D. Jones,** and **C. S. Monnier.**

A new field office at Spanish Fork, Utah, has been opened by the Bureau of Reclamation with **Rulon H. Sorenson** in charge.

A. J. Bindler and **C. L. Dalgell** have formed a consulting engineering partnership in New York City to specialize in process engineering and structural design.

R. J. Graham has reopened his office as a consulting structural engineer in Chicago, Ill.

Axel R. Lind assistant director of public works for Stratford, Conn., and with the department for 15 years, has resigned in order to devote his entire time to his general contracting and road building firm.

Charles Randlett, city engineer of Redwood City, Calif., has resigned to enter private practice.

Guy F. Hinshaw, with the Federal Works Agency in Richmond, Va., and Washington, D. C., since 1942, has rejoined the private engineering office at Winston Salem, N. C. which he conducted for 27 years.

T. B. McDorman, captain, Corps of Engineers, of Atlanta, Ga., formerly with the Worthington Pump and Machinery Corp., construction division, southeast, is on inactive status after four years in the U. S. Army.

George Coffey, commander, after four years in the Navy, has become city engineer at Redlands, Calif.

S. W. Rowe, formerly in the R.C.A.F., has been named district engineer for the department of public works at The Pas, Man., succeeding V. I. Campbell, retired.

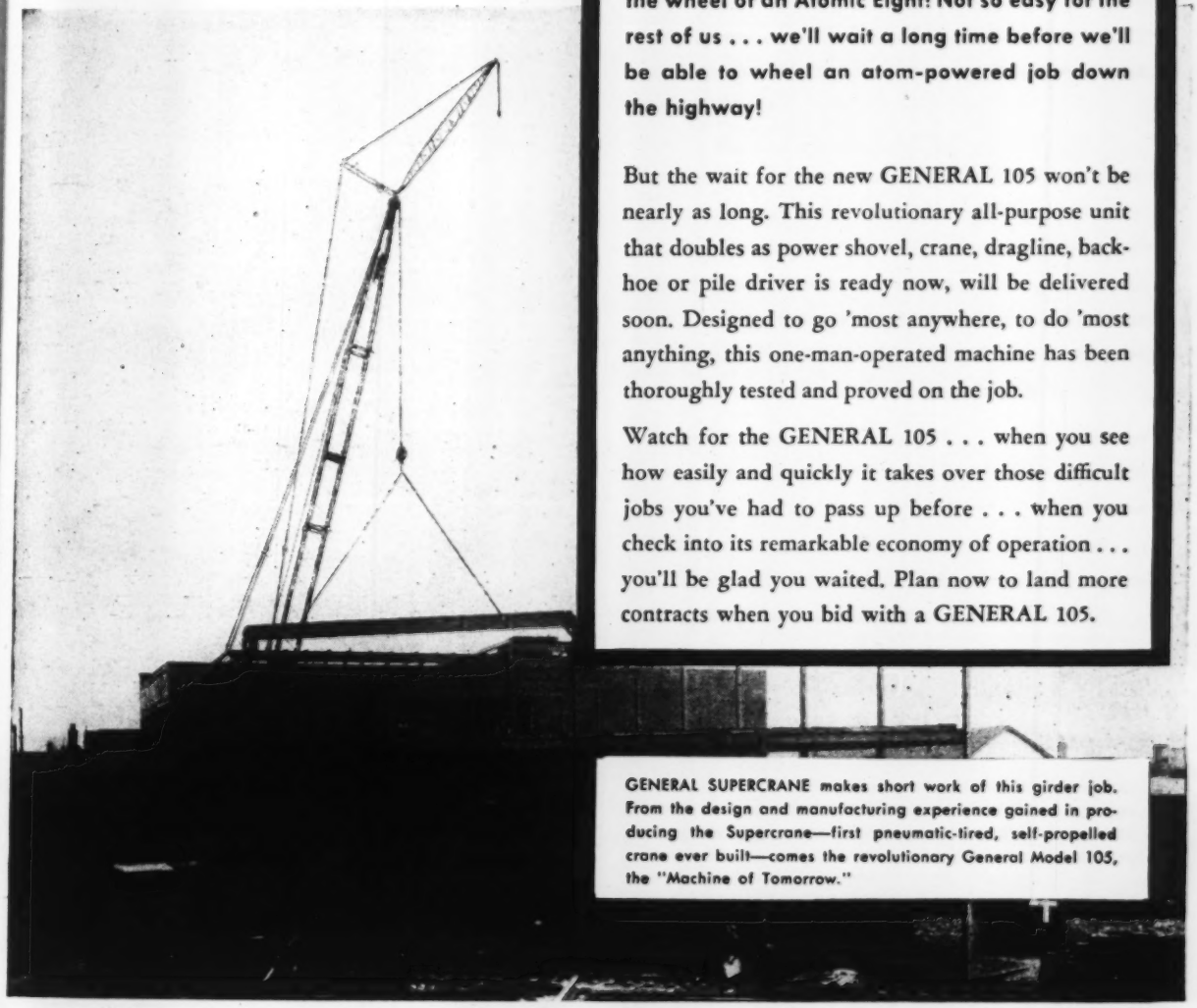
The *General* Has Everything . . .

Including an Atom-Powered Automobile!

The genial old "General" is always the first to acquire these "postwar wonders" . . . a word to the artist and there's the old boy, sitting behind the wheel of an Atomic Eight! Not so easy for the rest of us . . . we'll wait a long time before we'll be able to wheel an atom-powered job down the highway!

But the wait for the new GENERAL 105 won't be nearly as long. This revolutionary all-purpose unit that doubles as power shovel, crane, dragline, back-hoe or pile driver is ready now, will be delivered soon. Designed to go 'most anywhere, to do 'most anything, this one-man-operated machine has been thoroughly tested and proved on the job.

Watch for the GENERAL 105 . . . when you see how easily and quickly it takes over those difficult jobs you've had to pass up before . . . when you check into its remarkable economy of operation . . . you'll be glad you waited. Plan now to land more contracts when you bid with a GENERAL 105.



GENERAL SUPERCRANE makes short work of this girder job. From the design and manufacturing experience gained in producing the Supercrane—first pneumatic-tired, self-propelled crane ever built—comes the revolutionary General Model 105, the "Machine of Tomorrow."

THE GENERAL 105 • ONE-MAN OPERATED • ONE-ENGINE POWERED • MOUNTED ON RUBBER
WATCH FOR IT!

THE OSGOOD COMPANY
SHOVELS, DRAGLINES
CRANES
CRAWLER & WHEEL MOUNTS
DIESEL, OIL, GAS, ELECTRIC

Associated with The Osgood Company

GENERAL EXCAVATOR CO.
MARION, OHIO

GENERAL
CRANES, DRAGLINES
AND SHOVELS
DIESEL, GAS, ELECTRIC

Investigate NOW!

Caine CORR-PLATE Steel Piling

STRONGEST per POUND WEIGHT

Used the World over for building Foundations, Dams, Retaining Walls, Docks, Levees, Bulkheads, Sewers, Disposal Plants and thousands of other construction jobs.

CAINE STEEL COMPANY

STEEL PILING DIVISION, 1820 N. Central Avenue, Chicago 39, Illinois

BE WISE, "MOBILE-IZE!"

You can increase efficiency and simplify operations of almost any type of equipment by making it portable: Investigate the uses of EWC Wheels, Axles, Springs, Tongues, etc., to give your equipment added value. Write today for illustrated Bulletins, and for sound engineering help based on more than half a century of experience.

Make Your Machines Mobile with EWC Mountings

Electric Wheel Co., Dept. EN Quincy, Ill.

EWC WHEELS

Manufacturers' Activities

H. L. Bechner and A. D. Way have been appointed technical manager and chief mechanical engineer, respectively, of The Permutit Co., it was announced by H. W. Foulds, president of the water conditioning firm.

H. L. Bechner

In his new capacity, Mr. Bechner will be responsible for the company's technical policy on the application, guarantee and performance of its products, which include zeolites, ion exchangers, de-aerators, chemical feeds, de-gasifiers and precipitation equipment. He will also serve as chairman of the engineering committee.

Mr. Way, as chief mechanical engineer, will administer the Engineering Department and supervise the mechanical design and layout of equipment.

A. D. Way

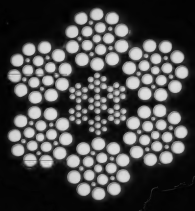
C. W. Pendock, president of Le Roi Co., Milwaukee, Wis., has announced the formation of "The Cleveland Division", to produce rock drills and related pneumatic equipment to serve the construction, mining and transportation industries, thus complementing the company's complete line of portable compressors which have been manufactured for 25 years.

A modern plant equipped with the latest types of machine tools, modern metallurgical, heat treating and testing facilities will be located in Cleveland, Ohio. Final design and testing have been completed on several series of tools and production will begin immediately.

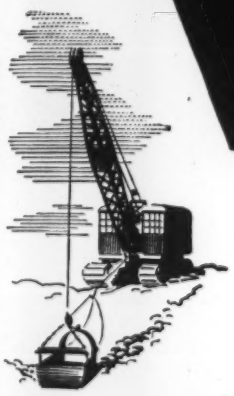
Russell R. Morgan, a former officer of The Cleveland Rock Drill Co., heads the Cleveland Division. A complete staff of development and design engineers has been engaged for nearly a year in bringing forth the entirely new line of Le Roi tools, consisting of:

Concrete Breakers—with pile driving heads and spike driving attachments. A complete line of moil points, chisels, etc.

Best for flexibility— and long wear!



UPSON-WALTON 6 x 16 FILLER WIRE CABLE



FOR drag cables on backfillers and dragline excavators . . . for cargo falls . . . for drag cables on drag scrapers . . . inclined shaft hoists . . . car and slope haulages . . . carry-all scrapers—*wherever* you need *BOTH* wear resistance and flexibility to a marked degree, Upson-Walton 6 x 16 Filler Wire Perfection Layrite is the ideal rope for your purpose.

This sturdy cable has *greater abrasion resistance* than 6 x 19 Filler Wire Rope, *greater flexibility* than 6 x 19 Seale. It is more flexible because there are a greater number of wires (21) used in its construction. It is better able to resist abrasion because the outer wires are larger in diameter.

Hemp center or, where operating conditions are very severe, IWRC (independent wire rope center).

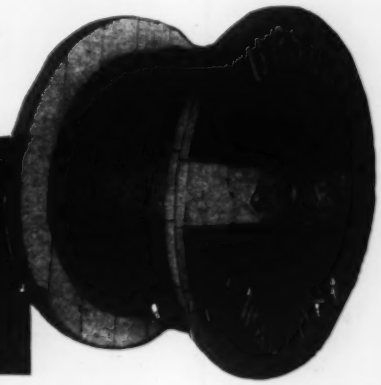
Perfection grade—because this finest of all improved plow steels is the strongest, toughest and most resistant to wear of all the grades of wire used to make rope.

Layrite—because this fine *pre*formed wire rope results in longer life, greater safety and greater economy.

Specify Upson-Walton 6 x 16 Filler Wire Perfection Layrite wherever you need greater flexibility combined with longer wear!

Established 1871

Copyright 1946—The Upson-Walton Company



THE UPSON-WALTON COMPANY

Manufacturers of Wire Rope, Wire Rope Fittings, Tackle Blocks

MAIN OFFICES AND FACTORY: CLEVELAND 13, OHIO

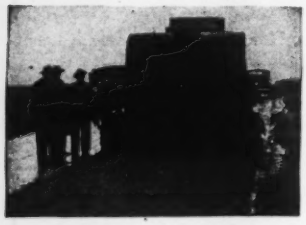
114 Broad Street, New York 4 · 737 W. Van Buren Street, Chicago 7 · 241 Oliver Building, Pittsburgh 22

Moto-Paver

THE COMPLETE TRAVELING MIXER AND PAVER

Does the Complete Mixing and Paving Job

● The Moto-Paver mixes, spreads and lays any type of mixed-in-place bituminous material to any road width, thickness and crown condition. No separate loader, spreader or other paving equipment is required—no trailer to haul the machine from one job to another.



Resurfacing Michigan Road with the Moto-Paver

The Moto-Paver does *the complete mixing and paving job,* and travels from one job to another under its own power. Paving speed is from 4 to 50 feet per minute, road speed up to 18 miles per hour. Mixing capacity 100 to 120 tons per hour. Bulletin MP-46, giving complete information and specifications, will be sent on request.

HETHERINGTON & BERNER INC.
730 KENTUCKY AVE. • INDIANAPOLIS 7, IND.

Also Builders of Portable and Stationary Batch Mix Plants of All Types and Capacities

Hetherington & Berner

Rock Drills—For both wet and dry drilling. A complete line of drill steels and Timken bits.

Clay Spades—Conventional and tee handle models. A complete line of spades, chisels, moils, etc.

Back Fill Tampers—With conventional butts as well as specialized butts for pole and post tamping.

Sump Pumps—Both single and multi-stage high efficiency units designed particularly for heavy duty service.

Wagon Drills—A wagon drill with features that will provide greater and wider use than ever before possible in this type of deep drilling equipment.

A full complement of tool accessories: Le Roi air and water hose; couplings, clamps, menders, spuds, etc.; manifolds, throttle valves, filters; line oilers.

JOHN LAWSON SENIOR, 67, chairman of the board of directors of the Consolidated Cement Corp. and president of the Florida, Signal Mountain and Trinity Portland Cement companies and the Cowham Engineering Co., died in New York City, recently. His home during recent years has been at Lenox, Mass. He was graduated from Cornell University Law School in 1901 and he became a member of the law firms of Blair and Senior in New York in 1906 and of Hurley, Mason and Senior in Tulsa, Okla. in 1912. Subsequently he became president of the Peninsular Portland Cement Co. and later organized and became president of the Cowham Engineering Co., the latter firm specializing in cement plant management, construction and design. In 1923 Mr. Senior became president of the Signal Mountain Portland Cement Co. and in 1925 he became president also, of the Florida Portland Cement Co. In 1933 he was elected

Increase Magnet Cable Life

★ Spring tension steadies magnet
★ Both cables feed together
★ Tension on tagline cable
★ Slack on electric cable

ELECTRIC CABLE CANNOT:
pull loose from terminals, tangle or snag

"It's the Sturdy FOOLPROOF COIL SPRING"

McCAFFREY-RUDDOCK TAGLINE CORPORATION
2121 EAST 25TH STREET • LOS ANGELES 11, CALIFORNIA

tops for welding

Aluminum Bronze... Magnesium Bronze... and Cast Iron... the...

WILSON ELECTRODE NO. 200

The Wilson electrode No. 200 is a general-purpose, D.C. reverse polarity, aluminum bronze rod offering you highest-quality welding at low cost. Designed for flat and horizontal welding, it produces deposits having the desirable properties of aluminum bronze, especially its high strength ... hot ductility ... and corrosion resistance.

In addition, this popular electrode may be used successfully for brazing dissimilar metals such as iron to steel ... arc welding the phosphorous bronzes (copper, tin, phosphorous alloys) ... producing sound, clean welds having high mechanical properties and excellent appearance on manganese bronze, Muntz Metal and brass ... and obtaining good results when arc welding malleable iron, clean cast iron and steel.

For full information on Wilson No. 200 as well as other Wilson Electrodes, fill in the coupon for a copy of Catalog No. ADW 75 and mail it today or address your nearest distributor.

WILSON

WILSON WELDER and METALS CO., INC.

General Offices: 60 EAST 42ND STREET, NEW YORK 17, N.Y.

Distributed by: A. M. CASTLE & COMPANY: Chicago, Seattle, Los Angeles, San Francisco; W. P. & R. S. MARS COMPANY: Duluth; KNIGHT & WALL COMPANY: Tampa; ARCOS CORPORATION: Philadelphia; THE CONGDON & CARPENTER COMPANY: Providence; J. M. TULL METAL & SUPPLY CO., INC.: Atlanta; H. BOKER & CO., INC.: New York, Cambridge, Mass.; GRAYBAR ELECTRIC CO., INC.: Pittsburgh, Cleveland, Cincinnati.

Represented Internationally by Airco Export Corporation

EN

WILSON
WELDER &
METALS CO., INC.

60 East 42nd St.
New York 17, N. Y.

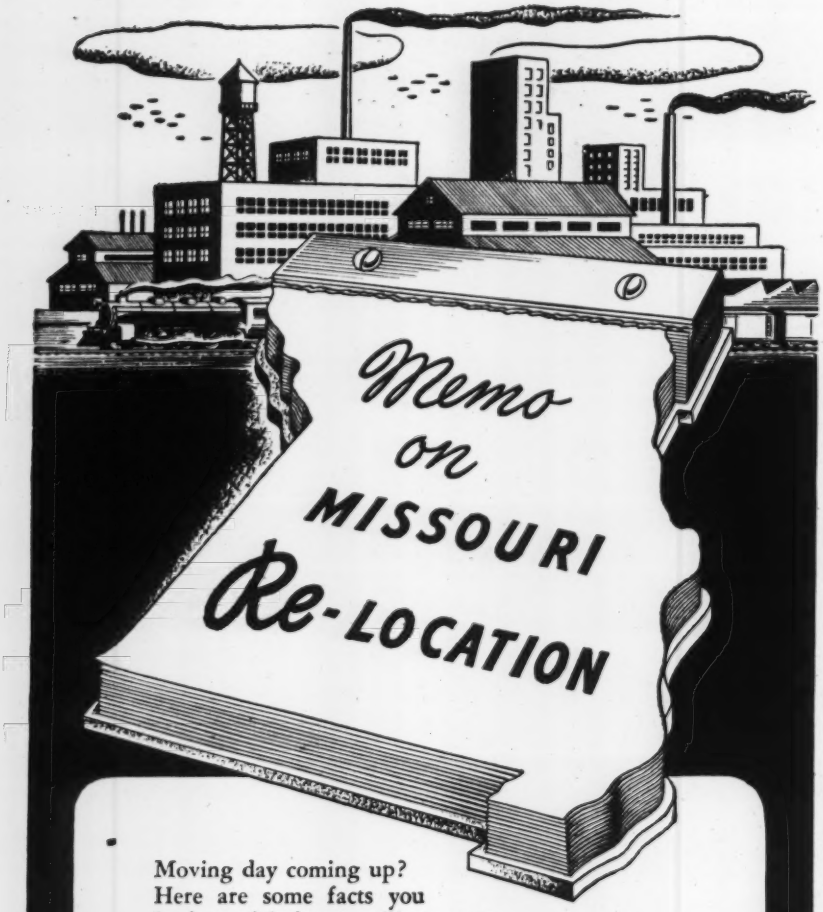
Please send me copy of Wilson Electrode Catalog No. ADW 75.
(1)

Name_____

Firm_____

Address_____

City_____ Zone___ State_____



Moving day coming up?
Here are some facts you leaders of industry will want to add to that memorandum. Whether yours is a parent plant or branch, Missouri offers these advantages:

- V **New State Constitution favors industry**
- V **Low Taxes**
- V **Over 950 new corporations last year**
- V **Adequate water supply**
- V **Abundance of skilled native labor**
- V **Excellent transportation facilities**
- V **Rich markets, retail and wholesale**
- V **Wealth of natural resources**
- V **Low cost power**
- V **350 communities eager to cooperate**

Specialized, confidential service to industrialists. Wire direct; Missouri State Department of Resources and Development, Department 702, Jefferson City, Missouri.

THE STATE OF MISSOURI
IN THE HEART OF AMERICA

president of the Trinity Portland Cement Co. He remained president of all of the above companies excepting the Peninsular, to the date of his death.

HOWARD O. PHIL has been elected secretary-treasurer of the Louis Allis Co., Milwaukee, Wis., to succeed his father, Oscar F. Phil, retired.

A. J. KERR has been elected vice-president of sales, Rockwell Mfg. Co., Pittsburgh, Pa. He was formerly general sales manager.

WESTERN EQUIPMENT CO., Portland, Ore., is distributor for the Michigan Power Shovel Co. and the Willamette Iron & Steel Corp.

WILLIAM E. MIKOLASY is eastern sales representative of the Stacy Brothers Gas Construction Co., Cincinnati, Ohio. Walter E. Flagg is sales representative in the New England states.

R. C. RICE is manager and J. B. Anderson assistant manager of the central district of the Manhattan Rubber division of Raybestos—Manhattan, Inc., Passaic, N. J.

A. H. PIPPINGER is the new sales manager of the J. D. Adams Mfg. Co., Indianapolis, Ind., for Iowa, Minnesota, Nebraska, North and South Dakota, Wisconsin and upper Michigan.

MASKIN-AGENTUREN, Helsinki, is distributor of Davey air compressors for Finland.

HEWITT RUBBER CORP., Buffalo, N. Y., has changed its name to Hewitt-Robins, Inc. It owns Robins Conveyors, Inc.

COL. B. O. HENDERSON, civil engineer, is sales manager of Miller, Bradford & Risberg Co., Eau Claire, Wis., distributors of road construction equipment.

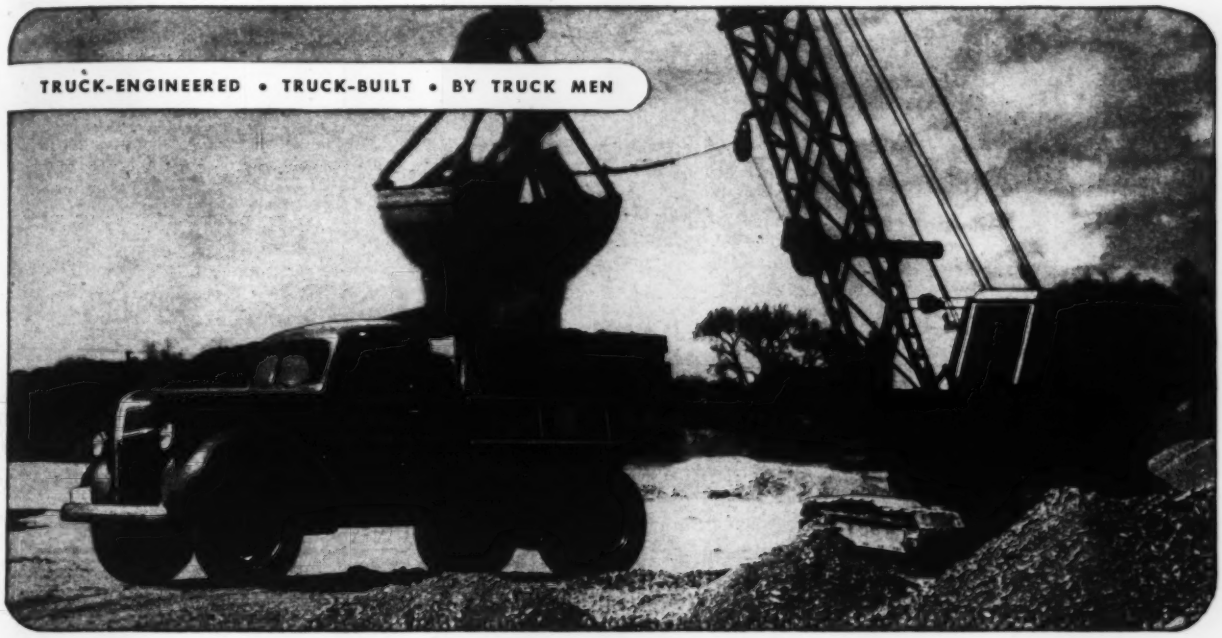
THE PORTLAND CEMENT ASSN. has established a conservation bureau headed by Ezra C. Wenger, for 11 years regional highway engineer for the association.

EARL M. KELLY and A. M. Kivari, sanitary engineers, have formed Process Engineers, Inc., San Francisco and Los Angeles, Calif.

THE SHAW SALES AND SERVICE CO. of Los Angeles, Calif., has been appointed sales representative for the Blaw-Knox Co.

R. B. JENNINGS, recently discharged as commander, CEC, USNR, has resumed as a branch manager of the Trane Co., La Crosse, Wis.

Ford Trucks Last Longer



"WE BELIEVE ONLY FORDS CAN DO THIS WORK AT THE SAME LOW COST"

The statement above is quoted from a letter received from Mr. C. A. Hurt, of Rock Hill Quarries Company, St. Louis, Mo. It sums up, we believe, the reasons why so many stone products producers and handlers look to sturdy Ford Trucks for thrifty transportation in their operations. Mr. Hurt describes his company's operation—

"Our twelve Ford Trucks haul crushed stone to street and road jobs. On new work, they often have to pull over new fills or back up on severe grades to put the stone where contractors want it."

"We have been using Ford Trucks since 1937, hauling an average of six tons per load. We believe they are the only trucks that can do this work for the same low cost per ton-mile. When we require Ford parts, the fact that Ford dealers are so near and parts so inexpensive makes this item negligible in our costs."

The new Ford Trucks now being built are the best in Ford history. Of especial interest is the new Ford Dump Truck Chassis, available with either the 100 HP V-8 or the 90 HP six-cylinder engine. Check its performance and capacity figures with your Ford Dealer. We believe you'll agree it's a real profit-earner.

Ford

FORD ADVANCED ENGINEERING!

THE FAMOUS V-8 ENGINE, for toughest service, now 100 HP, with NEW steel-cored Silvaloy rod bearings for trebled endurance • NEW Flightlight aluminum alloy 4-ring pistons for added oil economy • Tougher, rust-proofed valve springs • NEW moisture-sealed distributor • NEW coolant-saving radiator closure • Auto-balanced carburetion for still more thrifty power • Servicing simplified still further. And the rugged, thrifty 90 HP Ford six-cylinder engine, for stop-and-go jobs, with many important advancements, available in all except C.O.E. chassis.

Ford Truck rear axles—world-famous for load-lugging—provide generous reserve capacity • Light duty chassis have sturdy ¾-floating axles with triple-roller-bearing, straddle-mounted pinion; full-floating axles in all other chassis • 2-speed axle and vacuum power braking for 2-ton rating • Improved 4-speed transmission at extra cost in light duty chassis, standard in all others.

FORD TRUCKS

MORE FORD TRUCKS IN USE TODAY THAN ANY OTHER MAKE

Leupold Builder's Level

for

Engineers
Architects
Contractors

L&S

You'll search a long time to find an instrument comparable to this Leupold product. Men who use it confirm our belief that all requirements are conveniently incorporated in this one accurate, moderately priced level.

Telescope is external focusing, 13 inches long, with 1¼ inch objective; achromatic lens with a flat field and magnification of 18 diameters . . . Horizontal circle for turning angles and two auxiliary standards to which the telescope may be shifted for plumbing vertical lines . . . Instrument weight—8 lbs. Tripod weight—7 lbs . . . Hardwood carrying case.

Use coupon for literature

LEUPOLD & STEVENS INSTRUMENTS
Manufacturers since 1907
PORTLAND 13, OREGON
Surveying • Hydrographic • Navigation
Automatic Controls

Leupold & Stevens Instruments
4445 N. E. Glisan St., Portland 13, Oregon
Please send literature on Leupold Builder's Level

Name _____

Organization _____

Title _____

Street _____

City _____ *Zone* _____ *State* _____

WILLIAM P. LOYZELLE is traffic manager of the American Locomotive Co. for all divisions except the Railway Steel Spring. He is at Schenectady, N. Y.

WALTER W. WALB has been elected to succeed his father, the late Clyde A. Walb, as president of the American Steel Dredge Co., Ft. Wayne, Ind.

ANNOUNCEMENT is made of the election of W. C. Swalley as vice-president of The Wellman Engineering Co., Cleveland, Ohio, to be in charge of sales, and of A. J. Lichtinger, vice-president, to be a director.

DRAVO CORP., Pittsburgh, Pa., has announced the new location of its New York Offices at 30 Church Street.

THE CHICAGO BRIDGE & IRON CO. has reopened its sales office in Detroit, Mich., in the Lafayette Building. Edward D. Barrett, formerly of the Chicago office, is in charge.

FRED C. WALTER, associated with the sales, advertising and product development department of the Formica Insulation Co., Cincinnati, Ohio, is now assistant sales manager.

E. S. GRAYBILL has been appointed manager of the acoustical department of the building materials division of the Armstrong Cork Co., succeeding V. R. Despard, Jr., resigned.

THE NEW YORK office of the Sterling Engine Co. has been moved from 900 Chrysler Building to 401 Fourth Ave., New York 16, N. Y.

THE BLAW-KNOX CO., has appointed Ross Builders Supplies, Inc., of Greenville, S. C., to represent it in the sale of steel grating in South Carolina.

FRED A. EIDSNESS, Southeast district manager for Infilco, Inc., has moved his headquarters to the 215 Church Street Building, Decatur, Ga.

REITER ENGINEERING CO., INC., Philadelphia, Pa., has been appointed agent by S. P. Kimmey Engineers, Inc., to handle the Brassert automatic self-cleaning water strainer in the Philadelphia district.

HUNTER TRACTOR & MACHINERY CO. of Milwaukee, Wis., has appointed S. A. Felder vice-president. He has been with the company since 1928.

APPOINTMENT of the Wylie-Stewart Machinery Co., Oklahoma City, Okla., as sales agent for Lima shovels, crane and draglines in Oklahoma is announced by Shovel and Crane Division, Lima Locomotive Works, Inc., Lima, Ohio.

Standard gate valves can be inserted in any line up to 48" in size, without interrupting the flow or even reducing the pressure. The procedure is simple, fast and economical. The nuisance of shutting down the line and the expense of dewatering is entirely eliminated.

SMITH Valve Inserting Machines can be purchased or rented. Write for information.

THE A. P. SMITH MFG. CO.

DUFFIN IRON COMPANY

Established 1878

FABRICATORS of STRUCTURAL STEEL

Buildings, Bridges and All Types of Steel Structures

•

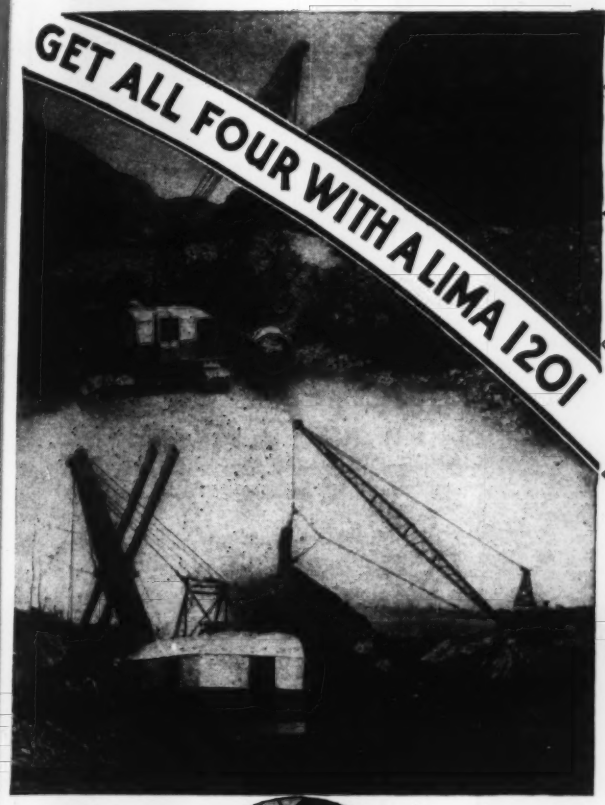
General Office and Works:
4837 So. Kedzie Ave.
Chicago 32, Ill.
Phone: Lafayette 0732

•

Contracting Office:
Suite 1600 - 27 W. Van Buren St.
Chicago 5, Ill.
Phone: Harrison 8813

•

For Service and Dependability Have it Fabricated by Duffin!



GET ALL FOUR WITH A LIMA 1201

1 ANTI-FRICTION BEARINGS THROUGHOUT

2 HOIST, SWING TRAVEL and BOOM UP OR DOWN AT THE SAME TIME

3 BIG WIDE DRUMS . . .

4 "PRECISION" AIR CONTROL . .

The more precise the MACHINE the better the PERFORMANCE

EASY TO OPERATE

LESS FATIGUE

The LIMA Type 1201 is designed, engineered and built for heavy duty construction—for the job that demands more than the ordinary. As a standard shovel it is equipped with a 3½ cubic yard dipper, 32′ 6″ boom and 22′ 0″ dipper handle. For high lift work a 42′ 0′ boom, 32′ 0″ dipper handle and 2½ cubic yard dipper can be furnished. As a crane it has a lifting capacity of 65 tons. Dragline capacities vary, depending upon the nature of the work. Whatever the job, whether it be tough rock digging, working as a dragline, in wet swampy ground or crane work where heavy lifts must be made with utmost precision, you'll find that the LIMA Type 1201 will fit into your plans exactly. Every day, more and more users of excavating machinery are turning to LIMA for the most in excavator design.

LIMA LOCOMOTIVE WORKS, INCORPORATED

Shovel and Crane Division . . LIMA, OHIO, U.S.A.

NEW YORK, N. Y. · NEWARK, N. J. · LOS ANGELES, CALIF. · ST. LOUIS, MO. · MINNEAPOLIS, MINN. · SAN FRANCISCO, CALIF. · SEATTLE, WASH. · DALLAS, TEXAS · MEMPHIS, TENN. · PORTLAND, OREGON · SPOKANE, WASH.

LIMA

SHOVELS ¾ YARD TO 5 YARDS DRAGLINES -- VARIABLE CRANES 13 TONS TO 100 TONS

Anybody else

want to have better Wrench Service?

If so, do as these boys did —*Get A LOWELL.*

For 77 years Lowell's have given service that satisfies, that is why we have stayed in business and why users have insisted on a LOWELL.

Have You Tried Them?
Better Start Now.

SEND FOR CATALOG TODAY

LOWELL
WRENCH CO.
Worcester Mass.

LACLEDE

LACLEDE WELDED DOWEL SPACERS

RIGID – ACCURATE

FOR CONTRACTORS, LACLEDE DOWEL SPACERS provide a light weight, economical method of placing dowels and joints. Distribution bars, supports, and dowel sleeves are all welded into one integral unit for rapid joint assembly. Shaped tie wires accurately locate fibre or steel joint materials.

FOR ENGINEERS, LACLEDE DOWEL SPACERS provide a rigid, accurate, prefabricated assembly for holding each end of each dowel in exact location. Both horizontal and vertical alignment of the dowels can be maintained on even the most irregular subgrades within limits prescribed by highway engineers.

LACLEDE STEEL COMPANY
ARCADE BUILDING SAINT LOUIS 1, MISSOURI

THE N. C. RUSSELL CO., Thermoseal Co. and the Triple Service Window Mfgr. Co. of Cleveland and the Diamond Welding & Mfg. Co., Columbiana, Ohio, have been merged.

THE BAUM BOULEVARD division of the Blaw-Knox Co. has been renamed the Chemical Parts division.

FRANK C. ROE is eastern field manager of the sewage equipment division of the Chicago Pump Co., and Stanley E. Kappe is sales representative.

HOWARD KALBFLEISCH is a sales engineer for the Simplex Valve & Meter Co. at Detroit, Mich.

GUS N. ARNESON is general superintendent of Washington Veneer Co., Olympia, Wash.

FERDINAND W. ROEBLING, 3D, has been appointed vice-president in charge of engineering for John A. Roebling's Sons Co., Trenton, N. J., succeeding Charles M. Jones, now vice-president for public and industrial relations.

J. C. TYGER is sales manager of the Dredge and Pump division of American Steel Dredge Co., Inc., Ft. Wayne, Ind.

BRIG. GEN. W. C. KABRICH has joined the Flintkote Co. as assistant director of research at East Rutherford, N. J.

JOHN F. HUTSON is district sales manager of the National Malleable and Steel Castings Co. for the Chicago territory. Assistant is Frank E. Moffett.

LIEUT. COMMANDER ROBERT S. GREEN has succeeded his father, Allen P. Green, as president of the A. P. Green Fire Brick Co., Mexico, Mo.

S. A. FELDER is vice-president of the Hunter Tractor & Machinery Co., Milwaukee, Wis.

JOHN MAY is assistant to the president of the American Steel and Wire Co., Cleveland, Ohio. Harry M. Francis succeeds him as vice-president in charge of sales.

J. PAUL SCHEETZ has joined the Rust Engineering Co., Pittsburgh, Pa., in an executive capacity.

B. P. SPANN, after 38 months in the Navy is back as advertising manager of the Gardner-Denver Co., Quincy, Ill.

THE ENGINEERING and research staffs of Nordstrom Valve Co. and Edward Valves, Inc., affiliates of the Rockwell Mfg. Co., Pittsburgh, Pa., have been pooled.

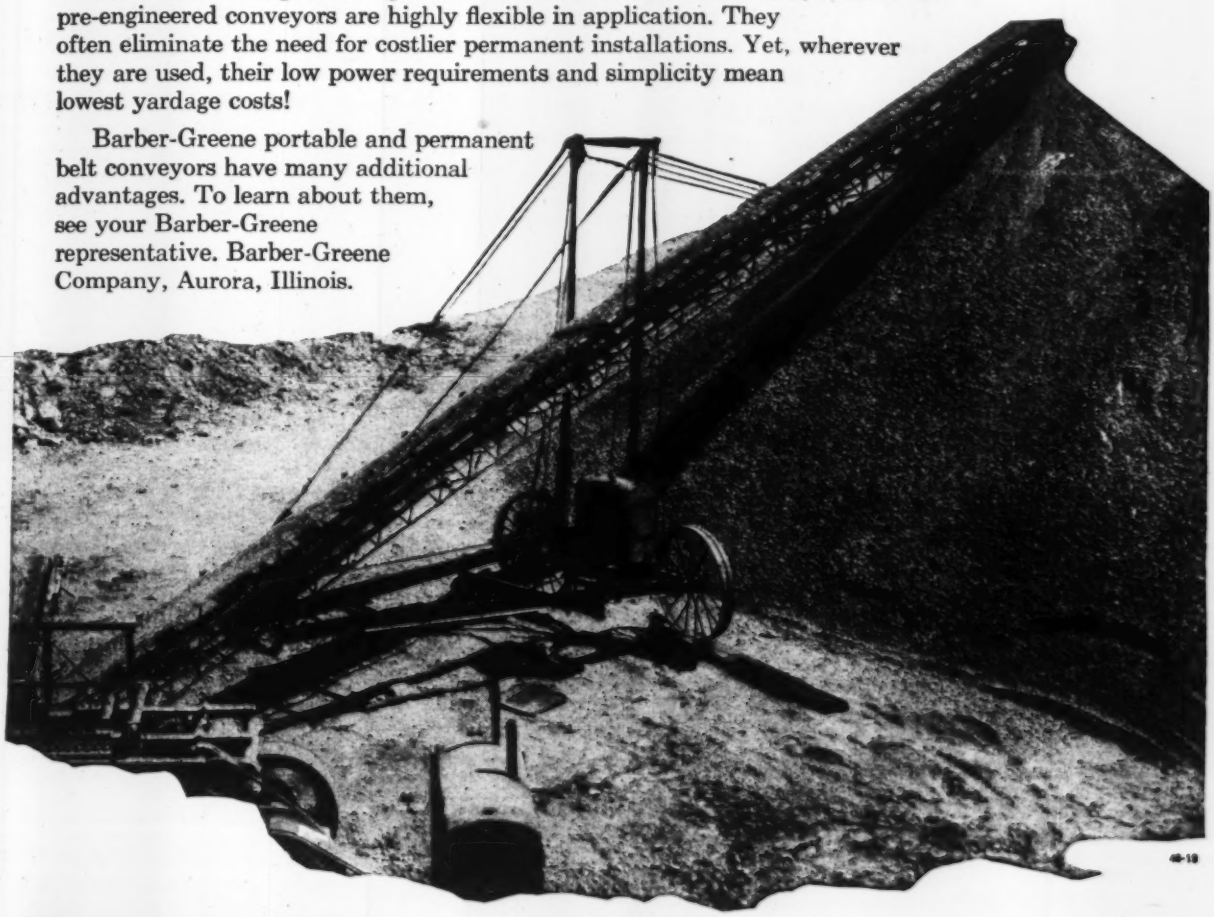
Why Portable Conveyors do so much—for so little

• B-G portable belt conveyors keep materials on the move at a constant flow that means high daily capacity wherever they're put to work.

They can move all over the job, the quarry, the supply yard—stock piling and loading everything from sand to cement, crushed rock to coal.

Shortened or lengthened by the addition or removal of sections, these B-G pre-engineered conveyors are highly flexible in application. They often eliminate the need for costlier permanent installations. Yet, wherever they are used, their low power requirements and simplicity mean lowest yardage costs!

Barber-Greene portable and permanent belt conveyors have many additional advantages. To learn about them, see your Barber-Greene representative. Barber-Greene Company, Aurora, Illinois.



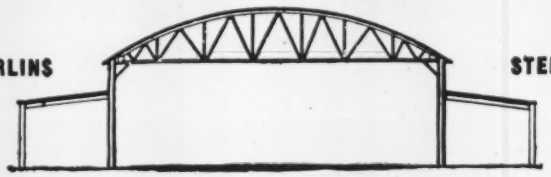
BG Barber-Greene CONSTANT FLOW EQUIPMENT

LOADERS • PERMANENT CONVEYORS • DITCHERS • PORTABLE CONVEYORS • FINISHERS • BITUMINOUS PLANTS • COAL MACHINES

MACOMBER

STANDARDIZED SERVICE IN STEEL CONSTRUCTION

ROOF TRUSSES AND ROOF PURLINS | STEEL JOISTS | LONGSPANS | STEEL DECKING AND STEEL SIDING



MACOMBER — Masters of the One Story Steel Building, have a real service for you. It includes:

1—Fabrication and erection of the complete building.

2—Fabrication of the roof supporting members only where masonry walls are used.

3—A wealth of engineering information as a result of specialization in this type of construction.

Here is standardization in steel building products that does not limit either you nor the occupant in the kind of building that serves his needs best. Your contractor knows Macomber products. He will expend far less equipment in their erection. If you are interested in some helpful suggestions and further information drop us a line.

MACOMBER

MACOMBER

CANTON • OHIO

MEMBER OF THE STEEL JOIST INSTITUTE

Manufacturers' Publications

Airport Electrical Equipment — A handsome, spiral wire-bound catalog describes equipment and approved plans for airport lighting projects. Since airport lighting first made night flying practicable, this company's research and engineering have been devoted to the development of better equipment for this important task. The equipment listed and described covers complete electrical requirements for airport lighting, and meets all applicable CAA and AN standards. Typical lighting layouts and layout plans for all classes of airports are includeed to help airport engineers in meeting specific requirements.—*Westinghouse Electric Corp., East Pittsburgh, Pa.*

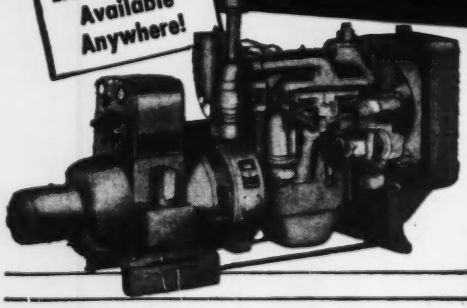
Floating Roof—A 12-page booklet discusses the reduction of evaporation loss and the elimination of fire hazard in flat-bottom tanks storing volatile liquids and chemicals. Gauging methods employed with flat-bottom tanks equipped with an improved floating roof are described and a diagram of a typical installation is shown.—*Chicago Bridge & Iron Co., 332 South Michigan Boulevard, Chicago 4, Ill.*

Radiant Heating—A 75-page book gives information on the theory, principles and advantages of radiant heating and the practical problems involved in its installation.—*Chase Brass & Copper Co., Inc., Waterbury 91, Conn.*

Flooring—A heavy-duty non-skid, non-absorbent and acid-resistant industrial flooring is described in an illustrated bulletin. This product is made with a blended aggregate of 100% selected emery, to which only cement and water

Makes Electric Power Available Anywhere!

Low Cost Electricity with READY-POWER ENGINE GENERATORS

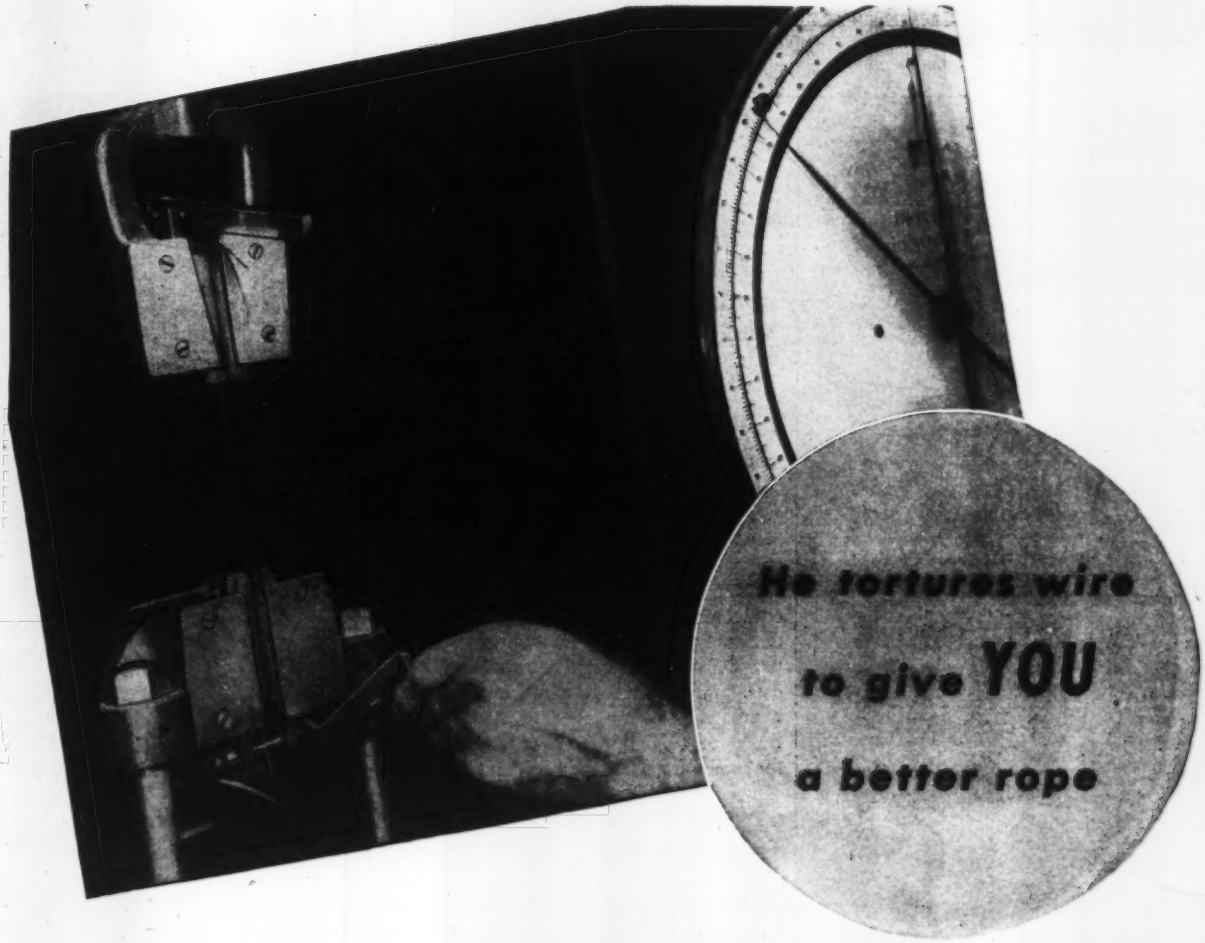


Powered by International Harvester Engines—Diesel, gasoline or natural gas. 7½KW to 50KW.

READY-POWER Engine Generators produce low cost electric power and permit the electrification of operations miles beyond the power lines. In many cases, important savings over central station power costs can be had. READY-POWER Engine Generators are sold and serviced by the world-wide International Harvester Power Unit dealer organization, and backed by the READY-POWER Company's twenty-two years of successful experience in producing engine generators.

THE READY-POWER CO.

11231 Froud Ave. • Detroit 14, Mich., U.S.A.



This Macwhyte laboratory technician is working in *your* interest. He gives the strength test to samples from each end of every coil of wire we make. Each sample is stretched to the breaking point. If it passes the test, the coil is tagged OK and used for Macwhyte Wire Rope. If not up to standard, the wire is rejected.

To make sure Macwhyte Rope will give you maximum service, the finished wire is also given a torsion or twist test to check its stamina. Granular structure is analyzed by a microscopic camera. Wire samples are rotated in an arc by a special machine that checks their ability to withstand fatigue.

Strict metallurgical control is another reason you can always depend on Macwhyte Wire Rope for long, economical life.

Make MACWHYTE your headquarters for WIRE ROPE and SLINGS

Macwhyte Wire Rope Catalog, G-15. 170 pages. Lists Macwhyte's full line, gives complete manufacturing story. Ask any Macwhyte representative or write Macwhyte Company.

MACWHYTE COMPANY

Wire Rope Manufacturers

2930 Fourteenth Avenue, Kenosha, Wisconsin

Mill Depots: New York · Pittsburgh · Chicago · Minneapolis · Fort Worth
Portland · Seattle · San Francisco · Los Angeles
Distributors throughout the U. S. A. and other countries

★ ★ ★ ★

MACWHYTE PREformed and Non-PREformed Wire Ropes—Internally Lubricated . . . MONARCH WHYTE STRAND Wire Rope . . . Special Traction Elevator Rope . . . Braided Wire Rope Slings . . . Aircraft Cables, Assemblies and Tie-Rods . . . Stainless Steel Wire Rope, Monel Metal Wire Rope, Galvanized Wire Rope.

MACWHYTE COMPANY 50th Year 1896 – 1946

The Smith Air Compressor is *right* for the majority of your jobs . . .

- **BIG ENOUGH** to operate medium weight rock drills, paving breakers, clay spades, tampers, large spray guns . . 60 cu. ft. capacity. Head equipped with high speed compressor valves. Automatic unloading and idling.
- **SMALL ENOUGH** to be towed at truck speeds from job to job. Initial and operating costs are low. Uses only 1 gal. of gas an hour! Its Ford motor and standard parts mean easy, low-cost maintenance. Don't waste money with oversize, unwieldy compressors. Use the power you pay for.
- Are you interested? Write, phone, or wire today!

GORDON Smith & CO. Incorporated

430 College St., Bowling Green, Ky.

are added. Comparative strength analyses of popular flooring materials used in plants and warehouses are charted. There are numerous installation photos and user-experiences drawn from diverse fields.—*Walter Maguire Co., Inc., 350 West 42nd Street, New York 18, N. Y.*

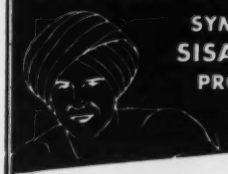
Paving Products—A new 16-page catalog lists and illustrates a complete line of paving joints, sealing, concrete curing and sewer joint compounds. Engineering designs and specifications are features in the 2-color folder. The same company has issued a folder on concrete curing compound tests. — *Keystone Asphalt Products Co., 43 E. Ohio Street, Chicago 11, Ill.*

Trailer Maintenance Manual — This book contains a section on safety of trailer operation with detailed instruction on the use and care of operating equipment; helpful suggestions for accident preventive maintenance; a guide for trouble-shooting; lubrication charts; and disassembly drawings showing parts and numbers. It provides self-service instructions for minor repairs or adjustments that may be performed without the aid of special tools and also without trained personnel.—*Fruehauf Trailer Co., Detroit 32, Mich.*

Shovels, Cranes, Draglines—A new bulletin describes shovels, cranes, and draglines. It features the application of precision air control, an advantage said to result in minimum fatigue, fewer delays, and greater efficiency. It also describes many other advantages, with illustrations of complete machinery and views showing the equipment in a wide variety of jobs. As a shovel this type has a capacity of 3½ cu. yd., as a crane, 65 tons, and as a dragline, variable.—*The Shovel and Crane Division, Lima Locomotive Works, Inc., Lima, Ohio.*

Cement Concrete Pavement—Results of a recent survey of the 48 state highway departments and the District of Columbia have been printed in tabulated form showing current practices of constructing expansion and contraction joints in cement concrete pavement, types of compounds used in sealing joints and materials used in curing the concrete. Materials used in making the joints are shown for each of the 47 agencies answering the questionnaire. Included also in the table are data on thickness of pavement, spacing of joints, types of centerstrip used by the various states, and other details of pavement jointing and curing of interest to the highway engineer. — *Keystone Asphalt Products Co., 43 East Ohio St., Chicago, 11, Ill.*

. . Meet the
UNSEEN GUARDIAN
SYMBOL OF
SISALKRAFT
PRODUCTS



✓ **SISALKRAFT**
. . . waterproof reenforced building paper

✓ **SISALATION**
. . . reflective insulation and moisture-vapor barrier

✓ **COPPER ARMORED SISALKRAFT**
. . . Sisalkraft plus pure electro deposit copper

THE SISALKRAFT CO.
CHICAGO, ILLINOIS

LINN HAFTRAK
SINCE 1916

Low Cost Per Ton-Mile
Manganese Tracks
Contour-following Traction
Sturdy Construction
5 to 50 Tons Capacity
Negotiates Steep Grades, Mud, Snow and Ice

For
Mining • Quarrying • Logging
Snow Plowing • Dam, Highway, Airport and Oil Field Work

The Linn Manufacturing Corporation
Morris, New York
Designers and Builders of

n the